

# **SCIENCE-X**

## **MODULE - 4**

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# LIFE PROCESSES



## INTRODUCTION

- Living organisms require oxygen, water and food in every cell of their various tissues to sustain life.
- The various processes essential for maintenance of life are called life processes, which are nutrition, respiration, transportation and excretion.
- Energy is continuously required by living organisms to carry out various life processes. This energy is liberated due to intake as well as utilisation of nutrients and also by respiration of an organism.
- Organisms can be classified into two groups - autotrophic and heterotrophic.
- Respiration is the process in which food is oxidised to release energy, which can be aerobic or anaerobic. The first step in respiration is called breathing.
- Animals have evolved different organs for the uptake of oxygen from the surroundings and for release of carbon dioxide.
- In human beings, the transport of materials like oxygen, carbon dioxide, food and excretory products is a function of the circulatory system.
- The circulatory system consists of heart, blood and blood tissues.
- In higher plants, transport of water, minerals, food and other materials is a function of the vascular tissue which consists of conducting tissues, xylem and phloem.
- All plants and animals produce harmful substances due to a number of metabolic activities occurring in their body tissues. These substances are to be eliminated from the body as they are toxic in nature.
- In human beings, excretory products in the form of soluble nitrogen compounds are removed by the nephrons in the kidneys. Plants use a variety of techniques to get rid of waste material; which are stored in the cell-vacuoles, removed in the falling leaves or excreted into the surrounding soil.



# 1. NUTRITION



***The whole process by which an organism obtains its food is referred to as nutrition.***

## NUTRITION

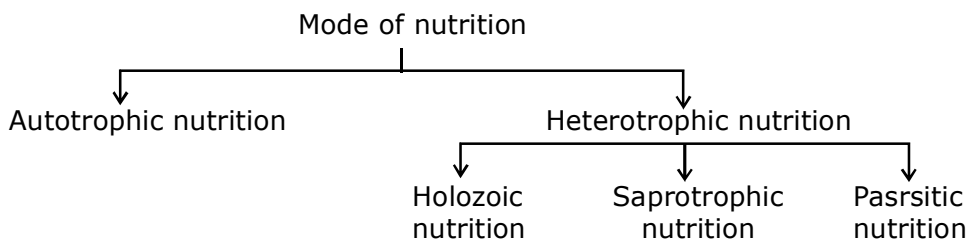
It is the method of obtaining nutrients from the environment. It can be defined as the process by which the organism ingests, digests, absorbs, transports and utilises nutrients and disposes off their end products.

## NUTRIENT

The different component of food that have distinct functions like providing energy, materials for body building, maintenance & regulation of metabolism are called nutrient.

For example- Proteins, Minerals, Vitamin, Carbohydrates, fats.

## MODES OF NUTRITION



### (a) Autotrophic Nutrition

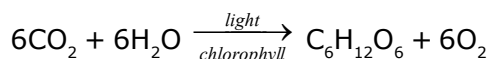
In this type of nutrition, organisms synthesise the organic materials they require from inorganic sources. All green plants are autotrophic and use light as a source of energy for the synthesis.

### Autotrophs

The organisms which make their own food from carbon dioxide and water in the presence of sunlight and chlorophyll are called autotrophs. These organisms are also called producers and include green plants and some bacteria.

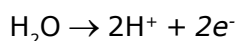
## PHOTOSYNTHESIS

It is the process by which green parts of the plant synthesise organic food in the form of carbohydrates from  $\text{CO}_2$  and water in the presence of sunlight.



In plants and most algae it occurs in the chloroplasts and there are two principal reactions:

(i) Light reaction (light-dependent) requires the presence of light energy from sunlight which is obtained by photosynthetic pigments, *i.e.*, chlorophyll and used to bring about the photolysis of water.



(ii) Dark reaction (light-independent) *i.e.*, this reaction is not dependent on light and during this reaction carbon dioxide is reduced to carbohydrate in a metabolic pathway known as the Calvin cycle.



## Difference between light and dark reactions

Features	Light reaction	Dark reaction
Requirement of light	Required	Not required
Takes place inside	Grana part of the chloroplast	The stroma region of chloroplast
ATP and NADPH <sub>2</sub>	ATP and NADPH <sub>2</sub> are produced by the conversion of light energy into chemical energy	ATP and NADPH <sub>2</sub> formed during light reaction are used for the fixation of CO <sub>2</sub> into carbohydrate
Sugar formation	No sugar formation takes place	Sugar formation takes place
Release of oxygen	Oxygen is released	No oxygen is released

## VARIOUS COMPONENTS OF PHOTOSYNTHESIS

Various components necessary for the process of photosynthesis are :

1. Chlorophyll
2. Carbon dioxide
3. Sunlight
4. Water

This can be demonstrated with the help of various experiments.

## 1. Chlorophyll

Chlorophyll is green pigment present in the green leaves.

## Activity-1.1

## SCIENCE COMES ALIVE

To prove that chlorophyll is essential for photosynthesis.

## Apparatus

Plant with variegated leaves, Apparatus for starch test i.e., iodine solution, beaker, test tubes.

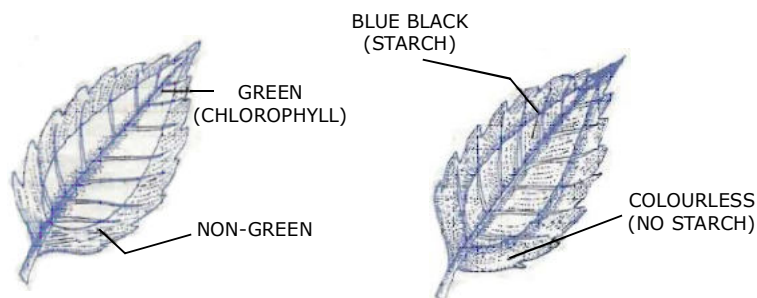


Fig. 1 Apparatus to show that chlorophyll is essential for photosynthesis

## Procedure

1. A potted plant with variegated leaf (Coleus, Croton) is kept in darkness for two days to make the leaves starch-free.
2. A plant is then kept in sunlight for few hours.
3. A leaf is removed from the plant and tested with iodine for starch, after decolourising it first with water and then alcohol.

## Conclusion

It is seen that the portions of leaves which are devoid of chlorophyll remain colourless (starch free) whereas the rest of the leaf turns blue-black due to the presence of starch.

## PRACTICE ZONE

1.1

1. Why do plants need magnesium ?
2. What type of the plants do we use in the experiment to prove that chlorophyll is necessary for photosynthesis.
3. What substance does a plant need to be able to convert glucose into proteins ?



## 2. Carbon-Dioxide

- Photosynthesis has been found to take place in a very wide range of  $\text{CO}_2$  concentration.
- Within the range the rate of photosynthesis will decrease or increase with decrease or increase in  $\text{CO}_2$  concentration, provided other factors are not limiting.
- Relatively high concentration of  $\text{CO}_2$  reduces the rate of photosynthesis and if given for a considerable period of time, has detrimental effect on the process itself.

### Activity-1.2

#### SCIENCE COMES ALIVE

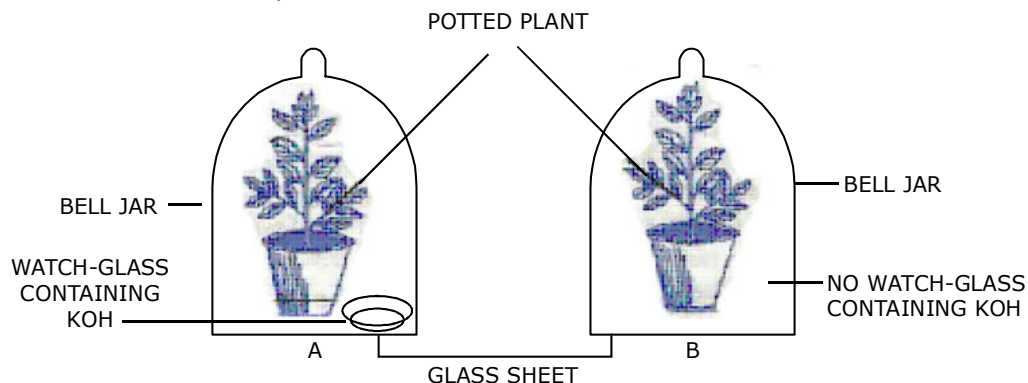
**To prove that carbon dioxide is necessary for the process of photosynthesis.**

#### Apparatus

Two healthy potted plants, Potassium hydroxide (KOH), 2 bell jars, watch-glass, vaseline, 2 glass plates, Iodine solution,  $\text{H}_2\text{O}$  and alcohol.

#### Procedure

1. Take two healthy potted plants of same size.
2. Destarch them by keeping in a dark room for 3-4 days.
3. Now place these potted plants on separate glass sheets.
4. Place watch glass containing KOH by the side of one of the plants. KOH has the property to absorb carbon dioxide.
5. Now cover these potted plants with bell jars.
6. To make the apparatus air tight use vaseline to seal the bottom of the jars to glass plates.
7. Keep this experimental setup in sunlight for 3 to 4 hours.
8. Pluck one leaf from each plant.



**Fig. 2 Apparatus to show that  $\text{CO}_2$  is necessary for the process of photosynthesis**

9. Perform starch test for both the leaves by decolourizing leaf first in water, then in alcohol and finally testing with iodine solution.
10. Leaf which was within bell jar with KOH solution gives a negative test whereas other one gives positive test.

#### Conclusion

The experiment clearly proves the fact that carbon dioxide is absolutely essential for photosynthesis. The part of the leaf which could not show iodine test positive or manufacture starch had all the requirements for photosynthesis except  $\text{CO}_2$ , which was absorbed by KOH in the bottle.

	<b>ON YOUR TIPS</b>	
<p>The light intensity where in the photosynthesising organs neither takes <math>\text{CO}_2</math> nor release the same is called compensation point.</p>		

### 3. Sunlight

#### Activity-1.3

#### SCIENCE COMES ALIVE

To prove that light is necessary for photosynthesis-Starch Printing Test.

#### Apparatus

Ganong's light screen or two strips of black paper. A destarched plant, Apparatus for starch test.

#### Procedure

1. Take a Ganong's light screen. It has a small metallic box with ventilating holes. To the is attached a spring handle, bearing a lid at its one end which fits over the metallic box lightly. The lid has a design within its centre. You can even use two black paper strips to cover the leaf.
2. A potted plant is kept in the dark for two days to make the leaves starch free.
3. A leaf is partly covered with a piece of black paper or by a Ganong's light screen.
4. The pot is then kept in the sunlight for few hours.
5. The leaf is then tested with jodine solution for starch.

#### Conclusion

It is seen that the starch is formed only in the exposed portion of the leaf whereas covered portion remains starch-free because light was not available to such patches for photosynthesis.

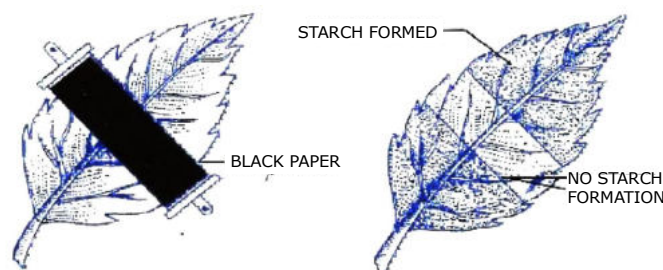


Fig. 3 Apparation to show that light is required for phtosynthesis

#### PRACTICE ZONE

1.1

1. Plants need magnesium to make chlorophyll.
2. Desarched potted plants with variegated leaves eg. Croton and Pothos.
3. Nitrogen.

#### 4. Water

- Plants absorb water from the soil with the help of root system. The effect of water deficiency on the rate of photosynthesis is indirect one.
- Decrease in  $H_2O$  content of the leaves may cause partial or complete closure of stomatal opening, and hence a reduction in the rate of diffusion of  $CO_2$ .
- A partial drying of the cell walls cause decrease in its permeability to  $CO_2$ , Another indirect effect of water deficiency is that the accumulation of sugar within the cells increases the rate of respiration and thus decreases apparent photosynthesis

#### (b) Heterotrophic Nutrition

The type of nutrition in which organisms derive their food (nutrients) from other living organisms. In heterotrophic nutrition, the energy is derived from the intake and digestion of the organic substances, normally of plant or animal tissue. Heterotrophic mode of nutrition are of different types :

##### (i) Saprotrophic Nutrition

It refers to the mode of nutrition in which organisms obtain nutrients from the dead and decaying organic matter, e.g., fungi, yeast and bacteria are called saprophytes.

##### (ii) Parasitic Nutrition

It refers to the mode of obtaining food synthesised by others. The organism which obtains food is called the 'parasite' and the organism from which food is absorbed is called the 'host'. This nutrition is observed in fungi, bacteria, a few plants like *Cuscata* and some animals like *Plasmodium* and roundworm.

##### (iii) Holozoic Nutrition

It refers to the mode of nutrition in which the complex organic matter in the form of solid food is ingested, digested and then absorbed into the cells and utilised, e.g. amoeba, frog, human beings.

#### Heterotrophs

The organisms which cannot make their food and depend directly or indirectly on autotrophs for their survival are called heterotrophs. These organisms include animals and fungi.



## TYPE OF HETEROTROPHIC NUTRITION

### 1. Saprophytic or Saprotrophic Nutrition :

It is a mode of heterotrophic nutrition in which food is obtained from organic remains like dead organisms, excreta, fallen leaves, broken twigs, food articles, etc. Organisms performing saprophytic nutrition are called saprophytes.

### 2. Parasitic Nutrition :

It is a mode of heterotrophic nutrition in which a living organisms flourishes by obtaining food from another living organism. The living organisms which obtains food and shelter from another organism is called parasite. The organism which provides food and shelter to a parasite is known as host. An external plant parasite is *Cuscuta* (Amarbel). It is a non-green plant that sends haustoria or sucking roots into host plant for obtaining food and water.

### 3. Holozoic Nutrition :

It is a mode of heterotrophic nutrition which involves intake of solid pieces of food. Since solid food is taken in, holozoic nutrition is also called ingestive nutrition. The food may consist of another animal, plant or its parts. Depending upon the source of food, holozoic organisms are of three types – Herbivores, carnivores, omnivores.

#### Herbivores :

(L.*herba*-plant, *vorare*-to eat)

They are holozoic organisms which feed on plants or plant parts, e.g., Cow, Buffalo, Deer, Goat, Rabbit, Grasshopper, Elephant, Squirrel, Hippopotamus.

#### Carnivores :

They are animals which feed on other animals. Carnivores are also called predators they hunt, kill and feed on their preys, e.g. Lion, Tiger, Leopard, Snake, Hawk.

#### Omnivores :

(L.*omnis*-all, *vorare*-to eat)

They are holozoic organisms which feed on both plant and animal materials, e.g. Cockroach, Ant, Pig, Crow, Rat, Bear, Dog, Humans.

## NUTRITION IN AMOEBIA

Protozoan protists carry out holozoic nutrition through intracellular digestion.

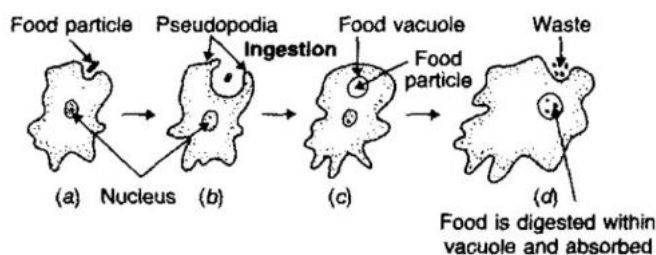


Fig. - 4 Nutrition in Amoeba

	<b>ON YOUR TIPS</b>	
Free-living platyhelminthes (e.g., planaria) possess both kinds of digestion. Humans have extracellular digestion.		

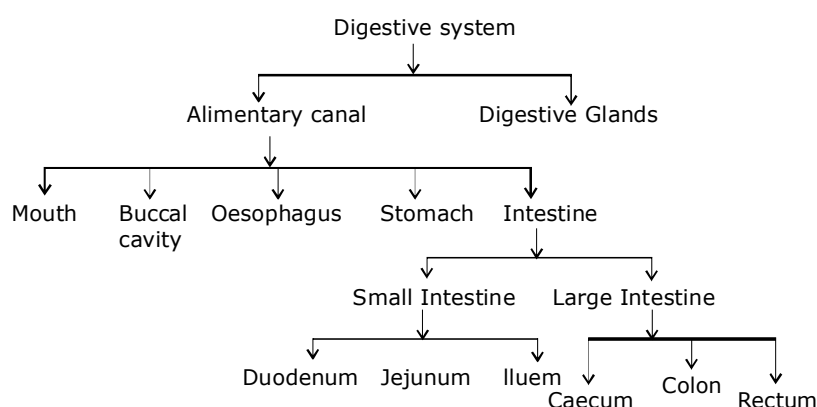


Some protists can ingest food particle from any point on the surface (e.g., Amoeba) while others have fixed points for the same (e.g., Paramecium). Protozoans like Amoeba capture food with the help of temporary finger-like processes called pseudopodia. Protozoans like (Paramecium have small hair-like processes called cilia.) Beating of cilia creates current in water that pushes food particle through cytostome or cell mouth. The process of ingestion of solid food particle by a cell or unicellular organism is called phagocytosis.

As soon as Amoeba comes in contact with a food particle or prey, it throws pseudopodia all around the same. The tips of encircling pseudopodia fuse and the prey comes to lie in a vesicle or phagosome. This method of intake of food is called circumvallation. Amoeba can also ingest food by other methods like import, circumfluence and invagination.

## DIGESTIVE SYSTEM OF HUMAN

The organs which are responsible for ingestion, digestion, absorption, assimilation and egestion constitute the digestive system. The digestive system comprises of the alimentary canal and associated digestive glands.



### (A) Alimentary canal

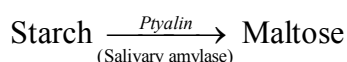
The alimentary canal is basically a long tube extending from the mouth to the anus. It is differentiated into following parts.

#### (i) Mouth



It is a transverse slit bounded by movable lips. The lips serve to close and open mouth. holding the food in between and also help in speaking.

The floor of the buccal cavity has a tongue bearing taste buds. Man possess teeth on both the jaws. There are 32 teeth of four different types, namely incisors, canines, premolars and molars.

- Digestion may be intracellular (Paramecium) or extracellular (multicellular animals).
- The process of digestion starts in the mouth cavity and continues upto the intestine.
- In the mouth, food gets mixed up with saliva secreted by salivary glands.
- Saliva contains an enzyme ptyalin which breaks polysaccharide starch into disaccharide maltose.



- The food from the mouth cavity passes into the stomach through the oesophagus.

	<b>ON YOUR TIPS</b>	
<p>Apart from the presence of food, the sight, smell or even touch of one's favourite food can initiate secretion of gastric juices.</p>		





## **(ii) Pharynx**

It is a short, conical region that lies after the mouth cavity. The pharynx are divided into two parts — the nasopharynx which lies behind the nasal cavities and the oropharynx which lies behind the mouth.

## **(iii) Oesophagus (food pipe)**

It is a long, narrow, muscular tube which leads to the stomach, The oesophagus is a collapsible muscular tube leading from pharynx to stomach. There are no digestive glands but mucus glands are present.

## **(iv) Stomach**

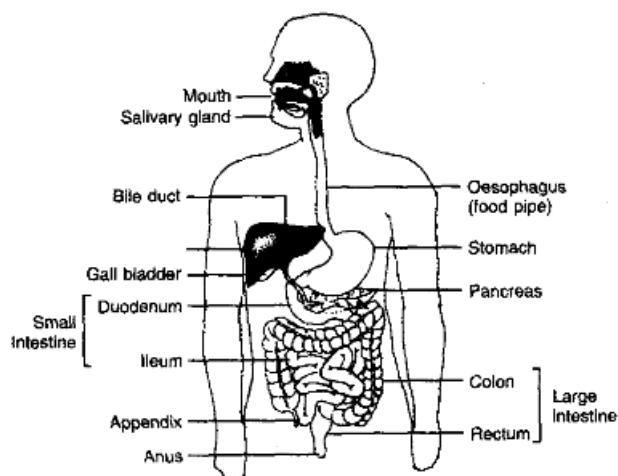
It is a thick, muscular and J shaped sac present on the left side of upper part of abdomen. Gastric glands are present in the wall of stomach. These releases gastric juice or digestive juice, which contains mucus, hydrochloric acid and a protein digesting enzyme called pepsin.

Mucus lubricated the food and protects the inner lining of the stomach from the action of HCl.

HCl creates an acidic medium, which facilitates the action of enzyme pepsin and kills the bacteria present in food.

Pepsin breaks down proteins into peptides.

Sphincter muscles regulate the exit of food from stomach into intestine due to peristaltic waves of stomach.



**Fig. -5 Human alimentary canal**

## **(v) Intestine**

It is the largest part of alimentary canal which is fitted into a compact space because of extensive coiling. It is distinguished into small intestine and large intestine.

### **• Small intestine**

The small intestine is the site of the complete digestion of carbohydrates, proteins and fats. It receives the secretions of the liver and pancreas for digestion.

Food is mixed with three digestive juices (bile juice, pancreatic juice and intestinal juice)

**Bile juice** (from the liver) provide alkaline medium and emulsifies fats (conversion of larger fat globules into smaller fat droplets) but it is non enzymatic digestive juice so has no chemical action on food.

**Pancreatic juice** (from the pancreas) contains trypsin, pancreatic amylase and pancreatic lipase enzymes which digest the peptons, starch and fats into peptides, maltose and fatty acids and glycerol respectively.

The wall of intestine secretes intestinal juice which contains enzymes for complete digestion of proteins into amino acids, carbohydrates into glucose and fat into fatty acid and glycerol.

The inner lining of the small intestine has numerous finger like projections called villi which increase the surface area for absorption of digested food.

These are richly supplied with blood vessels.



• **Large Intestine**

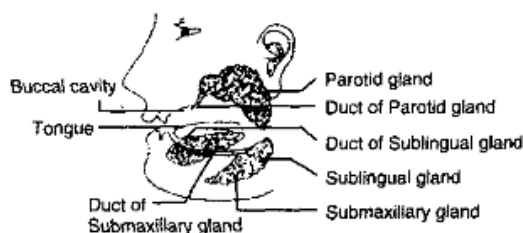
It is much shorter and wider than small intestine and is differentiated into three regions *viz.*, caecum, which is small rounded blind sac from which vermiform appendix arises; colon is the inverted U-shaped tube and the rectum opens to exterior through anus.

**(vi) Anus**

The rest of the material is removed from the body via anus. The exit of waste material is regulated by anal sphincter.

**(B) Digestive Glands**

Various glands associated with alimentary canal are :



**Fig. -6 Salivary glands of man**

	<b>ON YOUR TIPS</b>	
On eating food of our interest, watering starts in our mouth. This water is basically the saliva which is secreted by salivary glands that get activated by eating and even seeing or thinking of good food.		

**(i) Salivary Glands**

The salivary glands secrete the first of the digestive juices, the saliva. There are three pairs of salivary glands, namely the parotids, sub-maxillary and sublingual glands.

**(ii) Gastric Glands**

They are branched tubular glands which lie in the mucus membranes of the stomach. They secrete gastric juice, which is clear, acidic containing HCl, enzymes and mucus.

**(iii) Liver**

It is the largest gland in man and lies below diaphragm in the right upper part of abdomen. Liver comprises of two lobes, right and left, where the right lobe is much larger than the left lobe. The cells of liver, *i.e.*, hepatic cells produce bile juice which flows out of liver through hepatic ducts forming common bile duct and opens into duodenum. Bile juice then flows into gall bladder through the cystic ducts.



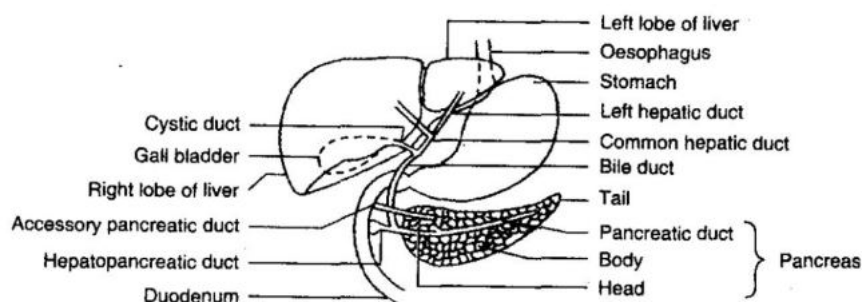


Fig. -7 Liver and Pancreas and their ducts

#### (iv) Pancreas

It is a soft lobulated gland present in between the loops of duodenum. It secretes pancreatic juice containing enzymes which is poured into duodenum with the help of pancreatic duct.

**Table: Summary of the digestive enzymes of various glands with their secretions and end products of Digestion in Man**

Name of the gland	Secretion	Site of action	Enzymes	Food acts upon	End product
1. Salivary glands	Saliva	Buccal cavity	Salivary amylase	Starch	Maltose
2. Gastric glands	Gastric juice HCl	Stomach	Pepsin Renin —	Proteins Casein of milk Pepsinogen	Peptones & proteoses Paracasein Pepsin
3. Liver	Bile	Duodenum		Fats	Emulsification of fats
4. Pancreas	Pancreatic juice	Duodenum	Amylase Trypsin Lipase	Starch & Glycogen Proteins Emulsified fats	Maltose & isomaltose Peptones & peptides Fatty acids & glycerol
5. Intestinal glands	Intestinal juice	Small intestine	Erepsin  Maltase Sucrase Lactase Lipase	Peptones & Peptides Maltose Sucrose Lactose Triglycerides	Amino acids  Glucose Glucose & fructose Glucose & galactose Monoglycerides & fatty acids
	Mucous	Large intestine	—	Lubrication of faecal matter	—



#### ON YOUR TIPS



It is the tooth decay which involves destruction of the enamel layer of the tooth by acids produced by the action of bacteria on sugar. If dental caries is not treated, it can spread to the dentine and pulp of the tooth, causing inflammation and infection of the tooth.

**N.C.E.R.T TEXT BOOK SOLUTION**

**Q.1** Why is diffusion insufficient to meet the oxygen requirement of multicellular organisms like humans?

**Ans.** In humans, the body organisation is multicellular and complex. The living cells are not in direct constant with environment because they are generally covered by dead cells. Air containing intracellular spaces are also absent so quick diffusion cannot occur. Cell to cell diffusion is very slow process and if it takes place in humans then passage of oxygen in whole body will take about years. Thus, diffusion is insufficient to deliver oxygen to all parts of a multicellular organisms like humans.

**Q.2** What criteria do we use to decide whether something is alive?

**Ans.** The main criterion that is used to decide whether something is alive, is movement. Movements may be of different types like locomotion (running, walking), moving body parts, breathing movements, growth movements and movement of molecules in various metabolic reactions. Besides movements, other qualities found in living beings are self-built body organisation, presence of protoplasm, self repair, various vital life processes like metabolism, growth, nutrition, respiration, excretion and reproduction. All living organisms have a definite lifespan and particular life cycle.

**Q.3** What processes would you consider essential for maintaining life?

**Ans.** The processes essential for maintaining life are nutrition, metabolism, respiration, circulation/transportation and excretion.

**Q.4** What are the differences between autotrophic nutrition and heterotrophic nutrition?

**Ans.** In autotrophic mode of nutrition, organisms (green plants, some protists and bacteria) prepare their own food from inorganic raw materials with the help of energy obtained from sunlight whereas in heterotrophic mode of nutrition, organisms obtain food prepared by autotrophs or from other organic sources as they cannot synthesise their own food. Heterotrophic nutrition may be saprophytic, parasitic and holozoic.

**Q.5** Where do plants get each of the raw materials required for photosynthesis?

**Ans.** The raw materials required for photosynthesis are carbon dioxide and water. Plants obtain water from the soil through roots and carbon dioxide from the atmosphere through stomata present on leaves.

**Q.6** What is the role of the acid in our stomach?

**Ans.** Hydrochloric acid (HCl) is secreted inside the stomach. The main functions of HCl are to

- (i) stop the action of salivary amylase
- (ii) kill the microbes present in the food
- (iii) provide acidic medium necessary for the activation of the enzyme pepsin
- (iv) make food soft
- (v) convert pepsinogen and prorennin into active forms of pepsin and rennin.

**Q.7** What is the function of digestive enzymes?

**Ans.** Digestive enzymes are hydrolytic in nature which help in digestion of carbohydrates, proteins and fats. They bring about hydrolytic splitting of complex organic substances into simple soluble and absorbable substances. For example, by the action of digestive enzymes, proteins are converted into amino acids.

**Q.8** How is the small intestine designed to absorb digested food?

**Ans.** Small intestine is a long, tubular structure. Its inner wall is lined by epithelium which possess numerous finger-like projections called villi. These villi not only increase the surface area for absorption but also reach deep into the lumen of intestine for maximum absorption of digested food. Villi possess blood capillaries and lymph vessels (lacteals) for quick transport of absorbed food.



**EXERCISE – I****NTSE /OLYMPIAD /FOUNDATION PROBLEMS**

- Q.1**  $\text{CO}_2$  and  $\text{O}_2$  balance in atmosphere is due to  
(A) Photorespiration (B) Photosynthesis (C) Respiration (D) Leaf anatomy
- Q.2** During photosynthesis the oxygen in glucose comes from  
(A) Water (B) Carbon dioxide  
(C) Both from water and carbon dioxide (D) Oxygen in air
- Q.3** With regards to natural eating habits, a human is  
(A) An herbivore (B) A carnivore (C) An omnivore (D) A Granivore
- Q.4** Muscular contractions of alimentary canal are  
(A) Circulation (B) Deglutition (C) Peristalsis (D) Churning
- Q.5** Which of the following regions of the alimentary canal of man does not secrete a digestive enzyme ?  
(A) Oesophagus (B) Stomach (C) Duodenum (D) Mouth
- Q.6** Saliva has the enzyme  
(A) Pepsin (B) Ptyalin (C) Trypsin (D) Rennin
- Q.7** Pepsin digests  
(A) Proteins in stomach (B) Carbohydrates in duodenum  
(C) Proteins in duodenum (D) Fats in ileum
- Q.8** If the stomach did not produce any hydrochloric acid, which enzyme will not function ?  
(A) Ptyalin (B) Trypsin (C) Pepsin (D) Collagenase
- Q.9** Chief function of bile is  
(A) To digest fat by enzymatic action  
(B) To emulsify fat for digestion  
(C) To eliminate waste product  
(D) To regulate process of digestion
- Q.10** Where is bile produced ?  
(A) In gall bladder (B) In blood (C) In liver (D) In spleen
- Q.11** Largest gland in human body is  
(A) Liver (B) Pancreas (C) Pituitary (D) Thyroid
- Q.12** The original function of the vertebrate stomach was  
(A) Storage (B) Digestion  
(C) Enzyme secretion (D) Absorption



**FILL IN THE BLANKS**

1. The whole process by which an organism obtains its food is referred to as .....
2. Other term for autotrophic nutrition is .....
3. .... manufacture their food from inorganic substances in the presence of energy derived from the oxidation of simple inorganic compounds of iron, sulphur etc.
4. The process of utilization of absorbed food is known as .....
5. Those organisms which depend on faecal matter of other organisms are known as .....
6. Light reaction is also known as ..... phase.
7. The light intensity, at which the photosynthetic intake  $\text{CO}_2$  is called ..... .
8. Ingestion of food in Amoeba takes place by the process of .....
9. .... is the type of digestion that occurs inside the lumen of digestive tract.
10. .... are known as suicide bags of the cell.

**ANSWER KEY**

- |      |      |       |       |       |      |      |
|------|------|-------|-------|-------|------|------|
| 1. B | 2. A | 3. C  | 4. C  | 5. A  | 6. B | 7. A |
| 8. C | 9. B | 10. C | 11. A | 12. A |      |      |

**FILL IN THE BLANKS**

- |                        |                           |                    |
|------------------------|---------------------------|--------------------|
| 1. Nutrition           | 2. a                      | 3. Chemoautotrophs |
| 4. Assimilation        | 5. Coprozoic heterotrophs |                    |
| 6. Photochemical phase | 7. Compensation point     | 8. Phagocytosis    |
| 9. Intercellular       | 10. Lysosomes             |                    |



**EXERCISE – II****PRACTISE FOR SUMMATIVE ASSESSMENT****Very Short Answer Type Questions**

- Q.1** Define heterotrophic nutrition.
- Q.2** What are heterotrophs ?
- Q.3** Which types of organisms are called consumers ?
- Q.4** What is saprophytic nutrition ?
- Q.5** Define saprophyte.
- Q.6** Define a herbivore.
- Q.7** What is carnivore ?
- Q.8** Which type of animal is called omnivore ?
- Q.9** What is the mode of nutrition in Amoeba ?
- Q.10** What type of digestion occurs in Paramecium ?

**Short Answer Type Questions**

- Q.11** How do saprophytic organisms obtain their nourishment ?
- Q.12** What is the importance of saprophytes ?
- Q.13** What is the action of hydrochloric acid of gastric juice ?
- Q.14** Name a digestive juice that has no enzymes. What is the role of this juice ?
- Q.15** Name the various parts of large intestine. What is the role of large intestine ?

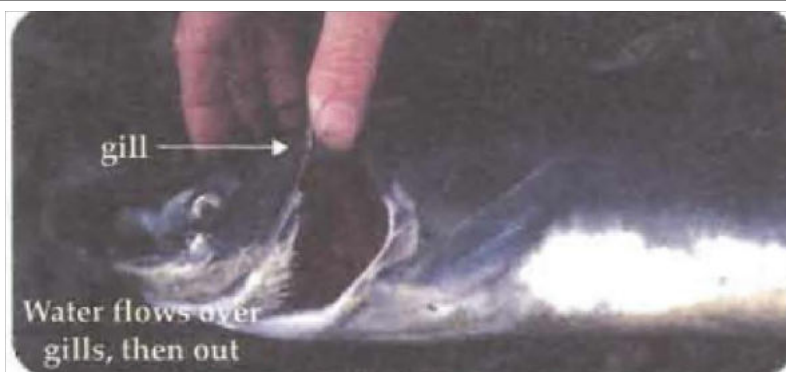
**Long Answer Type Questions**

- Q.16** Explain the mechanism of nutrition of Amoeba with the help of suitable diagram.
- Q.17** Describe the various types of heterotrophic nutrition.





## 2. RESPIRATION



***Respiration is essential for life because it provides energy for carrying out all the life processes which are necessary to keep the organisms alive.***

### INTRODUCTION

All living cells need a constant supply of oxygen to enable them to carry out the essential biochemical reactions of their metabolism. This oxygen supply is provided by the blood which also removes the  $\text{CO}_2$  and other waste products. Where does the blood get the oxygen, and what does it do with the  $\text{CO}_2$ ? The oxygen comes from the outside air, into which also the  $\text{CO}_2$  is discharged. The respiratory system provides the means of doing this.

#### Anabolism

It is the synthetic or constructive metabolism. In this case smaller molecules unite to form larger molecules. e.g., photosynthesis.

#### Catabolism

It is the destructive metabolism which involves the breaking down of large organic molecules. This is often accompanied with the liberation of energy e.g., respiration.

#### Metabolism

The sum total of the constructive (*anabolism*) and the destructive (*catabolism*) chemical changes occurring in living beings.

#### Breathing

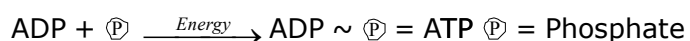
The process involving inspiration (intake of air or oxygen) and expiration (removal of air or carbon dioxide) is called breathing. No enzymes are involved in this process.

Breathing	Respiration
1. It is simply an intake of oxygen and removal of $\text{CO}_2$	1. It is an oxidation of food to form $\text{CO}_2$ , $\text{H}_2\text{O}$ and energy.
2. It is an extracellular process.	2. It is an intracellular process.
3. No energy is released.	3. Energy is released in the form of ATP molecules.
4. No enzymes are involved.	4. Enzymes are involved.

### Respiration

The process of releasing energy from food is called respiration.

**ATP.** It refers to a nitrogenous compound, Adenosine Tri-Phosphate. The energy released during cellular respiration is immediately used to synthesise a molecule called ATP from ADP and inorganic phosphate as



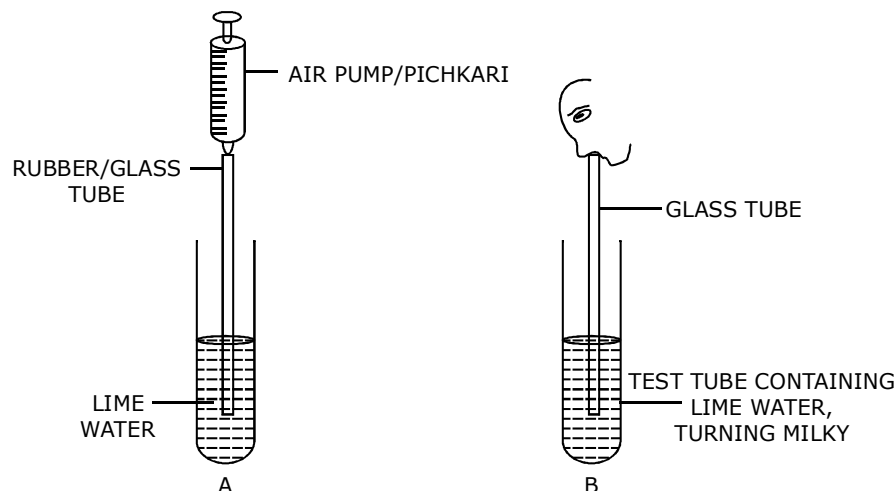
ATP is used to fuel all other activities in the cell. Therefore, it is said to be the energy currency for most cellular processes.



Activity-2.1

**SCIENCE COMES ALIVE**

**To demonstrate that carbon dioxide is given out during the process of breathing.**



**Fig. 1 Apparatus to demonstrate release of CO<sub>2</sub> during breathing**

**Apparatus**

Two test tubes, lime water, air pump or pichkari, glass tube, rubber tube.

**Procedure**

1. Take two test tubes and label them as A and B.
2. Put same amount of lime water in both of these.
3. Blow air with the help of glass or rubber tube in one test tube.
4. Note down time required to turn lime water milky in this test tube.
5. Then use syringe or pichkari to pass air through lime water in other test tube.
6. Note down time for turning lime water milky in this test tube.
7. Compare time taken to convert lime water milky in both the test tubes, A and B.

**Conclusion**

Time taken to turn lime water milky in test tube A is more than the one in test tube B. This tells that exhaled air has more CO<sub>2</sub> than atmospheric air.

**CELLULAR RESPIRATION**

It is the process of biochemical oxidation of nutrients in the presence of specific enzymes at optimum temperature in the mitochondria of cells to release energy for various metabolic activities.

Respiration is a catabolic process and there occurs exchange of gases viz oxygen and carbon dioxide, between the body and the outside environment.

It is of two types – aerobic and anaerobic respiration.

	<b>ON YOUR TIPS</b>	
Respiratory substrates are the organic compounds which are used in respiration to provide energy. Most common respiratory substrate is glucose.		

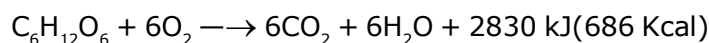


## Type of Respiration

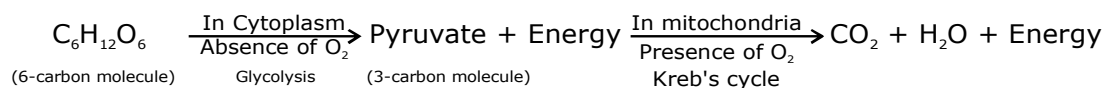
### 1. AEROBIC RESPIRATION

It is a type of respiration which occurs in the presence of oxygen.

The organisms showing aerobic respiration are called aerobes.



Break down of glucose occurs in various steps which can be summarized as :

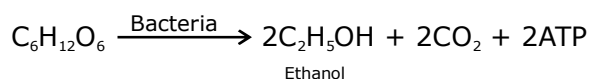


### 2. ANAEROBIC RESPIRATION

When food is oxidized without using oxygen is called anaerobic respiration.

#### (a) Fermentation

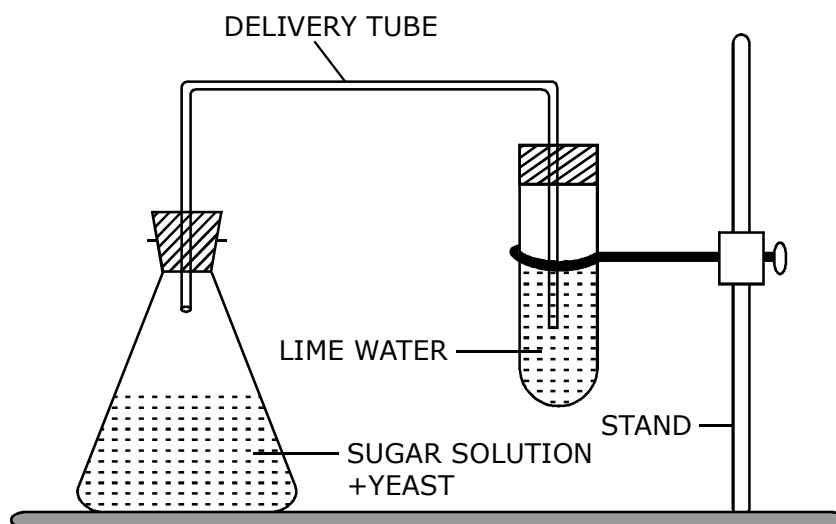
Anaerobic respiration is also called fermentation. It is found in lower organisms like anaerobic bacteria and yeasts :



#### Activity-2.2

#### SCIENCE COMES ALIVE

**To demonstrate the products formed during fermentation**



**Fig. 2 Apparatus to demonstrate the products formed during fermentation**

#### Apparatus

Conical flask, fruit juice, sugar solution, yeast, beaker or test tube with one-holed cork, twice bent glass tube, lime water.

#### Procedure

1. Take a conical flask and put some sugar solution or fruit juice in it.
2. Now add some yeast to it.
3. Fix flask with single holed cork with a twice bend glass tube in it.
4. Take some lime water in a beaker or test tube.
5. Dip twice bent glass tube fixed in a cork on a conical flask in the beaker containing lime water.
6. Leave this apparatus for few hours.
7. Lime water turns milky.
8. Note down the time required to do so.

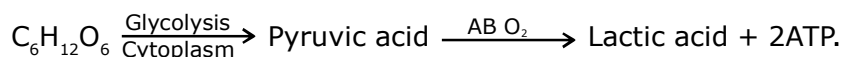


### Conclusion

In the above experiment yeast is respiring anaerobically as flask is covered with cork. This process of respiring anaerobically is called fermentation. This experiment shows lime water turning milky, thereby concluding that  $\text{CO}_2$  is released as a result of fermentation.

Sugar solution  $\xrightarrow{\text{Yeast}}$  Ethanol +  $\text{CO}_2$  + Energy

**(b) Temporary anaerobic respiration** may occur even in our own body in the fast working skeletal muscles, as in fast running, walking, swimming etc. The fatigue experience is due to lactic acid accumulated in the muscles in the shortage of oxygen, a condition which may be called **Oxygen debt**. When one rests after the exercise the lactic acid gets slowly oxidized by the oxygen later available and then the "debt" is cleared.





### DIFFERENCES BETWEEN AEROBIC AND ANAEROBIC RESPIRATION

Aerobic Respiration	Anaerobic Respiration
1. It uses oxygen for breaking of respiratory substrate	1. Oxygen is not required.
2. Glycolysis takes place in cytoplasm and Krebs cycle takes place in mitochondria.	2. It takes place in the cytoplasm.
3. 38 molecules of ATP are formed	3. 2 molecules of ATP are formed.
4. End products are $\text{CO}_2$ and $\text{H}_2\text{O}$ + Energy.	4. End products are $\text{CO}_2$ and ethanol
5. It is a normal method of respiration.	5. It is present only in a few organisms and in other, it occurs occasionally for short duration.
6. Respiratory material is completely oxidized	6. Respiratory material is not completely oxidized.

### PRACTICE ZONE

**2.1**

1. Name an organism which can live without oxygen.
2. Name two substances which are produced in anaerobic respiration but not in aerobic respiration.
3. During respiration in organism A, 1 molecule of glucose produces 2 ATP molecules whereas in an other organism B, 1 molecule of glucose produces 38 ATP molecules. Identify A and B.

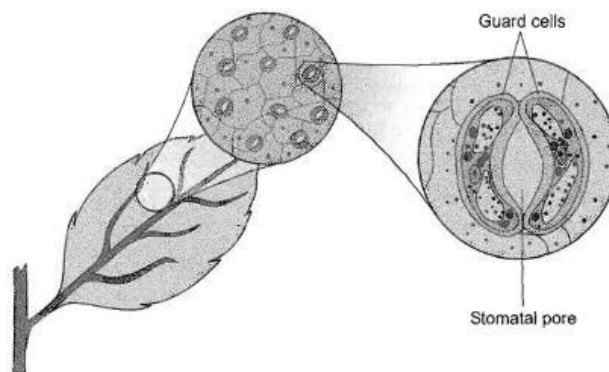
	<b>ON YOUR TIPS</b>	
<p>ATP is the energy molecule. Its full form is <b>Adenosine triphosphate</b>. ATP molecules are formed by using energy released during various steps of respiration by using ADP molecule (Adenosine diphosphate) and inorganic phosphate (iP).</p>		

### RESPIRATION IN PLANTS

Respiration in plants is simpler than the respiration in animals. Gaseous exchange occurs through:

- (i) Stomata in leaves
- (ii) Lenticels in stems
- (iii) General surface of the roots





**Fig. 3 Stomata**

**(i) Respiration through stomata :**

- Stomata are small apertures found on the surface of leaf.
- For the process of respiration, oxygen enters stomata by the process of diffusion and then into other cells of the leaf.
- This oxygen is utilized in the break down of glucose to carbon dioxide and water.
- This does not occur in a single step but in a series of steps.
- When concentration of  $\text{CO}_2$  increases inside the cells, it is diffused out through stomata.

**(ii) Respiration through lenticels :**

Lenticels are the openings in the bark of woody stems.

**(iii) Respiration through general surface of the roots :**

- Exchange of gases in roots take place by the process of diffusion, when oxygen diffuses into the root hairs and passes into the root cells, from where carbon dioxide moves out into the soil.
- In older roots there are no root hairs present. Instead they have layer of dead cells which is protective in nature and encloses small openings. These are used for gaseous exchange between soil and inner living cells.

**PRACTICE ZONE**

**2.1**

1. Yeast and most of bacteria.
2. Alcohol  $\text{C}_2\text{H}_5\text{OH}$  or lactic acid
3. (A) yeast (B) The cells or organisms that respire aerobically.

**A Little further 2.1**

Why a land plant may die if the soil is water logged ?

**Explanation**

Plant often die in water logged soil because the soil is unable to supply sufficient oxygen to roots. Under these condition root will respire anaerobically, producing alcohol.



**ON  
YOUR  
TIPS**



Respiration occurs for 24 hours and photosynthesis occurs only during the day. During day  $\text{CO}_2$  released during respiration is used up for the process of photosynthesis. Therefore, no carbon dioxide is released. Instead, oxygen is mainly released. The stage at which photosynthetic intake of  $\text{CO}_2$  is equal to the respiratory output of  $\text{CO}_2$  is called Compensation point.



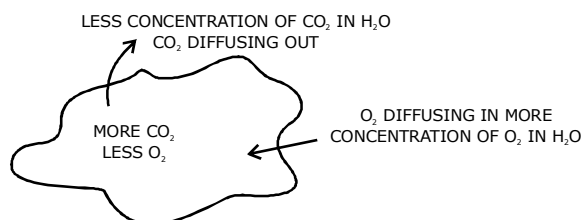
### DIFFERENCE BETWEEN RESPIRATION AND PHOTOSYNTHESIS

Respiration	Photosynthesis
1. It takes place 24 hrs. a day.	1. It takes place only in the presence of sunlight.
2. Respiration takes place in the mitochondria and cytoplasm of the cell.	2. Photosynthesis occurs inside the chloroplast.
3. It is a catabolic process.	3. It is an anabolic process.
4. It evolves $\text{CO}_2$ and $\text{H}_2\text{O}$ .	4. It utilizes $\text{CO}_2$ and $\text{H}_2\text{O}$ .
5. Results in weight loss	5. Results in weight gains.

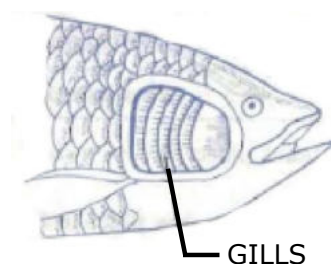
### RESPIRATION IN ANIMALS

It takes place with the help of some specific respiratory organs which differs in different animal groups, according to their habitat.

Aquatic animals like fish, prawns and mussels have gills as respiratory organs ; land animals like lizard, bird, human have lungs, frogs breathe both by skin and lungs and insects like grasshopper, housefly or cockroach have air tubes or trachea as their respiratory organs.



**Fig. 4 Respiration in amoeba**



**Fig. 5 Respiration in fish**

### HUMAN RESPIRATORY SYSTEM

This kind of respiration, where lungs are the main structures is called pulmonary respiration.

Respiratory system communicates with the outside atmosphere through external nostrils which draw air into nasal cavities.

**Respiratory organs in human beings consists of :**

1. Nostrils and nasal cavity    2. Nasopharynx    3. Larynx    4. Trachea    5. Bronchi
6. ALVEOLI    7. Lungs    8. Diaphragm

#### 1. NOSTRILS AND NASAL CAVITY

Nostrils are two nasal openings which serve like the gateway of the respiratory system. The nasal cavity has one central septum that divides the whole cavity into two parts.

The nasal cavity secretes mucus which helps to remove the dust particles from the air and air also normalizes the air while swallowing food.



**2. NASOPHARYNX**

It is the junction between the nasal cavity and the larynx. It is guarded by epiglottis which closes the passage of air to body temperature.

**3. LARYNX** (Also known voicebox)

It is the voice box which is interposed to prevent the entry of food material in the trachea. While swallowing this part rises and falls. Larynx contains two ligamentous folds called vocal cords. Air expelled between the vocal cords vibrates them producing sound.

**4. TRACHEA**

Trachea is about four inches long. It is composed of 16-20 incomplete cartilagenous rings. These cartilagenous rings ensure that trachea does not collapse even when there is very less air in it. The oesophagus is situated on the back of the trachea.

**5. BRONCHI**

The bronchi are formed by the bilateral bifurcation of trachea. Further divide into bronchioles which end into alveoli inside the lungs.



**6. ALVEOLI**

Alveoli are lined by a layer of epithelial cells and surrounded by a network of blood capillaries. Alveoli covers about area of 80 metre square when spread out. This large surface area helps in efficient exchange of gases.

**7. LUNGS**

These are two spongy elastic organs formed of alveoli bronchioles, blood vessels etc. The right lung has three lobes and the left lung has two lobes.

Lung is covered by a double membran known as 'pleura'. The visceral layer of the pleura is closely attached to the lungs. The free layer on the thoracic wall is known as parietal layer. Between two pleural layers, there is a fluid which lubricates the surface and prevents friction between the lungs and the chest wall during respiration.

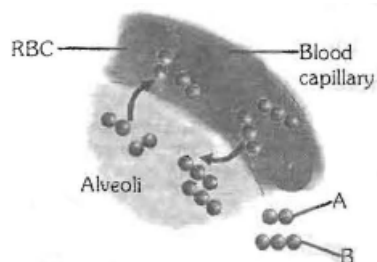
	<b>ON YOUR TIPS</b>	
The intrapleural pressure is important for bringing out respiratory movements.		

Air → Nostrils and nasal cavity → Nasopharynx → Trachea → Bronchi → Lungs → ALVEOLI





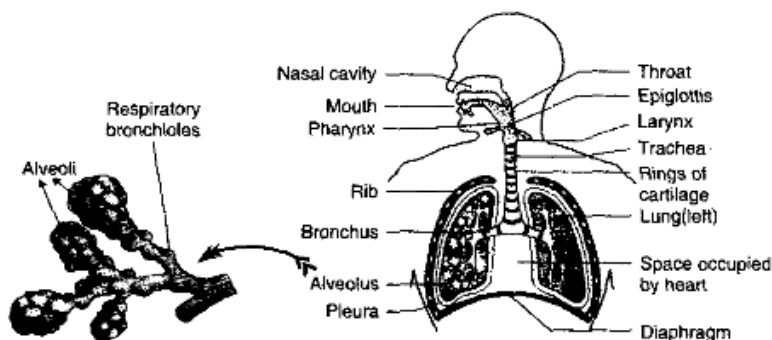
1. Identify the gaseous molecule A and B in below diagram.



2. What can happen when cartilaginous rings are absent on wall of trachea?
3. Why is  $\text{CO}_2$  mostly transported in the dissolved form in our blood?

## 8. DIAPHRAGM

It is a large dome shaped sheath of muscle which separates the thoracic cavity from the abdominal cavity. The contraction of diaphragm brings about its downward movement which decreases the intrathoracic pressure and increases the intra-abdominal pressure.



**Fig. 7 Human Respiratory System**

### A Little further 2.2

What are the adaptation for gaseous exchange in terrestrial organism?

#### Explanation

Terrestrial animals these possess some adaptation in their respiration structures to promote better exchange of gases. These adaptations are

1. Large surface area.
2. Thin permeable area
3. Abundant blood supply.

## MECHANISM OF BREATHING

Lungs cannot expand or contract of their own. The contraction and expansion of lungs is brought about by diaphragm muscles and external intercostal muscles.

### BREATHING DEFINATION

#### (A) Inspiration

It is also known as inhalation. It is as a result of combined action of the ribs and the diaphragm.

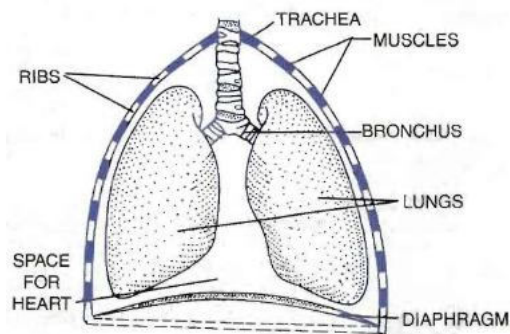
- Ribs move upward and outward by a set of muscles known as intercostal muscles thus enlarging the thoracic cavity.
- Diaphragm, which normally remains arched upward like a dome, towards the base of the lungs, flattens to an almost horizontal plane and thus enlarging thoracic cavity lengthwise.

As a result of above two actions of ribs and diaphragm, thoracic cavity increases in size. It leads to the decrease in pressure in the lungs as compared to the atmospheric pressure. Therefore, the atmospheric air which is at a greater pressure rushes into the lungs.



**(B) Expiration**

It is also known as exhalation. It is the reverse of inspiration. It again involves the action of ribs and diaphragm.



**Fig. 8 Diaphragm Depressed During Inspiration**

- Ribs move downward and inward by the action of other set of intercostal muscles.
- Diaphragm moves upwards to form a dome shape thus, putting pressure on lungs.

As a result, there is increase in pressure in the thoracic cavity as compared to the atmospheric pressure. Lungs are therefore compressed forcing the air out into the atmosphere.

	<b>ON YOUR TIPS</b>	
<p>Even after inhalation and exhalation of air, some air is left behind in the lungs. This is called <b>residual volume of air</b>.</p>		

**Gas Exchange in Alveoli**

- Blood rich in carbon dioxide, *i.e.*, the deoxygenated blood enters the capillary network of alveolus.
- $\text{CO}_2$  diffuses into the alveolar cavity because of its higher concentration in the blood.
- Alveolus has a higher concentration of oxygen as compared to the blood in capillaries.
- Therefore,  $\text{O}_2$  diffuses into the capillaries and combines with haemoglobin of red blood cells to form oxyhaemoglobin to be transported throughout the body.

**PRACTICE ZONE****2.2**

1. A is oxygen and B is carbon dioxide.
2. Trachea or wind pipe will be collapse and air (oxygen) will not reach into alveoli. Exchange of gases will be stopped.
3. Because  $\text{CO}_2$  is more soluble in water than oxygen hence is mostly transported in the dissolved form in our blood.

**Gas Exchange in Tissues.**

- In the cells, continuous metabolism of glucose and other substances results in the production of  $\text{CO}_2$  and utilisation of  $\text{O}_2$ .
- The concentration of oxygen in the cells and tissue fluid decreases while the concentration of  $\text{CO}_2$  is higher than in the capillaries.
- Therefore, oxyhaemoglobin breaks down releasing  $\text{O}_2$  diffuses out from the capillaries into the tissue fluid and then into each and every cell.



## **Lung volumes and capacities**

Spirometer is the instrument used to measure lung volume & capacities.

### **(1) Tidal volume**

Amount of air inhaled and exhaled during quiet breathing = 500 ml.

(a) Dead space air : A small amount of air breathed in respiratory tract that does not take part in gaseous exchange.

(b) Alveolar air : Part of tidal air takes part in gaseous exchange.

It occurs at alveoli is called alveolar air.

It is about = 350 ml.

### **(2) Inspiratory reserve volume (IRV) : (Complemental air)**

Maximum amount of air that can be inhaled forcibly following normal expiration (Tidal expiration).

It is about = 3000 ml.

### **(3) Expiratory reserve volume (ERV) : (Supplemental air)**

Maximum amount of air that can be expired forcefully after a tidal inspiration.

It is about 1000 ml.

### **(4) Residual volume :**

Volume of air that remains in lung after maximal expiration.

### **(5) Vital capacity :**

Maximum volume of air that can be takes in or expelled by maximum inspiration and expiration = 4500ml  
; V. C. = T. V. + I. R. V. + E. R. V.

### **(6) Total lung capacity :**

Maximum air which can at any time be taken in two lunge = 6000 ml.

TLC = V.C. + R.V.

Gas exchange occurs in alveoli. Fresh air has high concentration of oxygen and very low concentration of carbondioxide. As a result oxygen diffuses from alveolar air to blood present in capillaries around the alveoli. Carbon dioxide diffuses from blood in to alveolar air.

	Oxygen	Carbon Dioxide	Nitrogen	Water Vapours
Inhaled Air	20.84	0.04	79	Variable
Alveolar Air (after exchange)	13.1	5.3	79	Saturated
Exhaled Air	15.7	4	79.3	Saturated

- Respiratory cycle-inspiration, expiration and respiration pause.
- In adults respiratory rate is 12-14 breaths/min.
- In Newborn respiratory rate is 18-22 breaths/min.
- Increase % of CO<sub>2</sub> in blood leads to increase respiration.
- Slow and shallow breathing least to inadequate supply of oxygen.
- At altitudes above 5,000 m above sea level, one could easily suffer from dizziness, blackouts accompanied by impaired vision.
- As the altitudes increases, the pressure decreases resulting in decreases supply of oxygen.
- Respiratory rate and cycle is maintained by respiratory centres present in **Pons & Medulla**.



## N.C.E.R.T TEXT BOOK SOLUTION

**Q.1** Why is diffusion insufficient to meet the oxygen requirement of multicellular organisms like humans?

**Ans.** In humans, the body organisation is multicellular and complex. The living cells are not in direct contact with environment because they are generally covered by dead cells. Air containing intracellular spaces are also absent so quick diffusion cannot occur. Cell to cell diffusion is very slow process and if it takes place in humans then passage of oxygen in whole body will take about years. Thus, diffusion is insufficient to deliver oxygen to all parts of a multicellular organisms like humans.

**Q.2** How is respiration in plants is different from animals?

Respiration in plants	Respiration in animals
1. Respiration is carried out by all part of the plant i.e., roots, stem, leaves. 2. It occurs at slower rate. 3. In plates, there is little transport of gases to various parts of the plant. 4. Products of anaerobic respiration of glucose in plants are ethanol and $\text{CO}_2$ 5. There is no special gas transport system. 6. Green plants have additional oxygen source from photosynthesis.	1. Respiration occurs only in the respiratory organs. 2. It is faster in animals. 3. Transport of gases to various parts is more. 4. Products of anaerobic respiration of glucose is lactic acid and no $\text{CO}_2$ . 5. Blood transports oxygen. 6. Animals do not have any additional source of oxygen.

**Q.3** What are the differences between autotrophic nutrition and heterotrophic nutrition?

**Ans.** In autotrophic mode of nutrition, organisms (green plants, some protists and bacteria) prepare their own food from inorganic raw materials with the help of energy obtained from sunlight whereas in heterotrophic mode of nutrition, organisms obtain food prepared by autotrophs or from other organic sources as they cannot synthesise their own food. Heterotrophic nutrition may be saprophytic, parasitic and holozoic.

**Q.4** What advantage over an aquatic organism does a terrestrial organism have with regard to obtaining oxygen for respiration?

**Ans.** Terrestrial organisms take oxygen for respiration from air (21%) which is much more than in water (10%), so the terrestrial animals can take sufficient amount of oxygen to meet their high energy needs. On the other hand, aquatic organisms obtain oxygen which is dissolved in water. The amount of oxygen dissolved in water is very low.

**Q.5** What are the different ways in which glucose is oxidised to provide energy in various organisms?

**Ans.** The breakdown of glucose by living organisms follow two pathways

(a) Glucose in the presence of oxygen is converted into carbon dioxide and water. This process is called aerobic respiration.

(b) Glucose in the absence of oxygen is converted into carbon dioxide and alcohol. This process is called anaerobic respiration.

**Q.6** How are the lungs designed in human beings to maximise the area for exchange of gases?

**Ans.** Inside the lungs, the primary branches divide several times to form a network of tubes called bronchi. The branches finally lead into sac-like structures called alveolar sacs or alveoli. Alveoli are small rounded or polyhedral pouches that are thin-walled and have network of capillaries over their surface. There are about 300-700 million alveoli in both the lungs of humans which collectively provide a surface area of about 80 sq. metres which is more than 50 times that of skin (about 1.6 sq. metres).



**EXERCISE – I****NTSE /OLYMPIAD /FOUNDATION PROBLEMS**

- Q.1** Respiration is the process in which –  
 (A) energy is stored in the form of ADP  
 (B) energy is released and stored in the form of ATP  
 (C) energy is not released at all  
 (D) energy is used up
- Q.2** Which of the following is the source of respiration –  
 (A) Stored food (B) Fats (C) Glucose (D) Proteins
- Q.3** The form of energy used in respiration is –  
 (A) Chemical energy (B) Electrical energy  
 (C) Mechanical energy (D) Radiant energy
- Q.4** Respiratory structures in the insects are –  
 (A) Gills (B) Skin (C) Lungs (D) Trachea
- Q.5** The narrowest and most numerous tubes of lungs are termed as –  
 (A) Bronchus (B) Bronchioles (C) Alveoli (D) None of these
- Q.6** A normal man respire in a minute –  
 (A) 10-15 times (B) 14-18 times (C) 20-25 times (D) 25-30 times
- Q.7** In anaerobic respiration –  
 (A)  $O_2$  is given out (B)  $CO_2$  is given out  
 (C)  $CO_2$  is taken in (D)  $O_2$  is taken in
- Q.8** The exchange of gases [ $O_2$  and  $CO_2$ ] in a mammal takes place in –  
 (A) Trachea (B) Bronchi (C) Bronchioles (D) Alveoli
- Q.9** During inspiration muscles of diaphragm –  
 (A) Contracts (B) Expands (C) No effect (D) Coiled like string
- Q.10** Expiration involves –  
 (A) Relaxation of diaphragm and intercostal muscles  
 (B) Contraction of diaphragm and intercostal muscles  
 (C) Contraction of diaphragm muscles  
 (D) Contraction of intercostal muscles
- Q.11** The structure which prevent the entry of food into respiratory tract is –  
 (A) Pharynx (B) Larynx (C) Glottis (D) Epiglottis
- Q.12** In fever breathing rate –  
 (A) Increase (B) Decrease (C) Stop (D) None
- Q.13** Mammalian lungs are –  
 (A) Hollow (B) Solid and spongy  
 (C) Spongy (D) None



- Q.14** In respiration, air passes through –
- (A) Pharynx, Nasal cavity, Larynx, Trachea, Bronchi, Bronchiole, Lungs  
(B) Nasal cavity, Pharynx, Larynx, Trachea, Bronchi, Bronchiole, Lungs  
(C) Larynx, Nasal cavity, Pharynx, Trachea, Lungs  
(D) Larynx, Pharynx, Trachea, Lungs
- Q.15** Rate of respiration is directly affected by –
- (A) CO<sub>2</sub> concentration (B) O<sub>2</sub> in trachea  
(C) Concentration of O<sub>2</sub> (D) Diaphragm expansion

**FILL IN THE BLANKS**

- ..... is the synthetic or constructive metabolism.
- full form of ATP is .....
- ..... is the process involving the burning up of food substances to produce energy.
- ..... is a type of respiration in which there is no involvement of blood for the transport of gases.
- The fatigue experience is due to lactic acid accumulated in the muscles in the shortage of oxygen, a condition which may be called .....
- ..... is the movement of molecules from a region of higher concentration to a region of lower concentration.
- In fish exchange of gases take place through .....

**ANSWER KEY**

- |       |      |       |       |       |       |       |
|-------|------|-------|-------|-------|-------|-------|
| 1. B  | 2. A | 3. A  | 4. D  | 5. B  | 6. B  | 7. B  |
| 8. D  | 9. A | 10. A | 11. D | 12. A | 13. B | 14. A |
| 15. C |      |       |       |       |       |       |

**FILL IN THE BLANKS**

- |                       |                           |                |
|-----------------------|---------------------------|----------------|
| 1. Anabolism          | 2. Adenosine triphosphate | 3. Respiration |
| 4. Direct respiration | 5. Oxygen debt            | 6. diffusion   |
| 7. Gills              |                           |                |



**EXERCISE – II****PRACTISE FOR SUMMATIVE ASSESSMENT****Very Short Answer Type Questions**

1. What is the full form of ATP?
2. What is fermentation?
3. Write a chemical equation summarizing aerobic respiration.
4. What leads to muscle fatigue?
5. What are lenticels?
6. What is larynx?
7. How many ATP's are formed at the end of glycolysis?
8. Where does glycolysis takes place?
9. Where does Kreb's cycle takes place?
10. What are the end products of anaerobic respiration?

**Short Answer Type Questions**

1. Name three steps of aerobic respiration.
2. Distinguish between respiration and photosynthesis.
3. How does respiration takes place in Amoeba?
4. Discuss the role of diaphragm in breathing.
5. How does exchange of gases take place in alveoli?

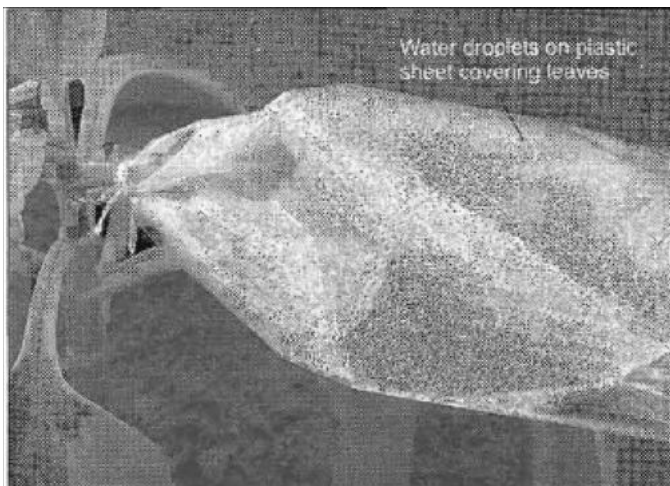
**Long Answer Type Questions**

1. Explain the process of anaerobic respiration.
2. Explain in detail various respiratory organs present in man.





### 3. TRANSPORTATION



***Transportation whether in plants or animals is the key to the efficient assimilation of the nutrients that the organisms synthesise, get from their environment or digest***

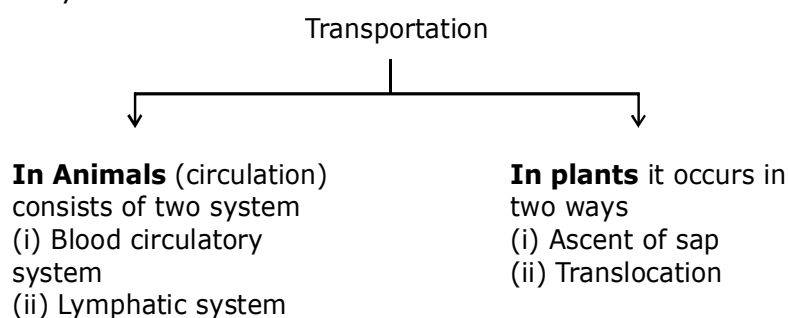
#### INTRODUCTION

Every living organism whether big or small, unicellular or multicellular, needs a regular supply of energy for its proper functioning. This energy is supplied to the body in the form of nutrients obtained from food. Moreover, the wastes generated are also to be removed from the body in order to maintain a proper equilibrium in the body. So, an arrangement is set up in every living organism to carry out the process of transports substances from one part to other part is called **transport system** or **circulatory system**.

**Transportation** in living beings is process through which nutrients (obtained during digestion), respiratory gases (obtained during respiration), excretory products, hormones, etc., are carried from one part to another part of the body. Transportation occurs in all organisms-microscopic to large ones. Depending upon the complexity of organisms, the method of transportation varies. **Diffusion is a major method of transportation in unicellular organisms** like protozoans (Amoeba and Paramecium) and also in simple multicellular organisms like cnidarians and sponges.

#### SIGNIFICANCE OF TRANSPORT SYSTEM

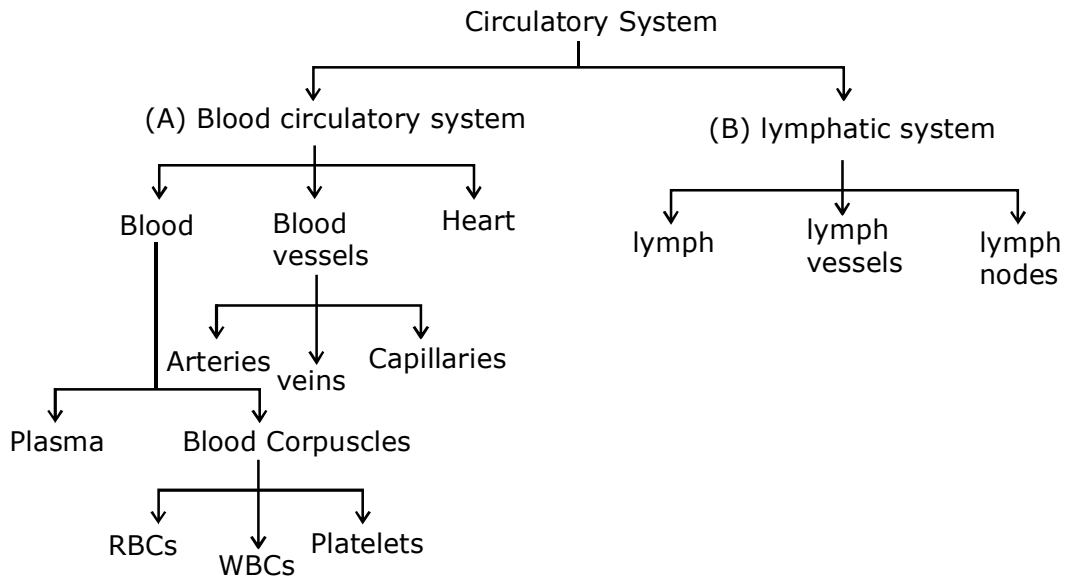
- (i) It transports food from the leaves in plants and small intestine (alimentary canal) in animals to each cell of the body.
- (ii) It transports oxygen from lungs to all body cells and carbon dioxide from all body cells to the lungs.
- (iii) It carries waste products to kidneys for elimination.
- (iv) The water absorbed by the plants is circulated to all parts through the transport system.
- (v) Hormones are formed in a particular area of the body. It is transported to the area of function via transport system.



## TRANSPORTATION IN HUMANS

The process of transporting the absorbed food, water and waste products from one place to another in the body is called circulation

In human beings, circulatory (transport) system comprises two system



### (A) BLOOD VASCULAR SYSTEM



**A system in which fluid is transported from one part of the body to the other through tubes is called vascular system.** Blood vascular system or circulatory system is a system used for transportation of blood between various organs of the body and the heart. The system is a complex network of hollow tubes called **blood vessels**. Blood vessels carry blood and connect heart to all other organs of the body.

The circulatory system has three different parts -

- (1) Pulmonary circulation (lungs)
- (2) Coronary circulation (Heart)
- (3) Systemic circulation (The rest of the systemics processes)

There are three major components of blood vascular system

- (i) Blood (fluid)      (ii) Blood vessels (tubes)      (iii) Heart

	<b>ON YOUR TIPS</b>	
Blood is little heavier than water. Its viscosity is 4.5 to 5.5 times that of water. Blood is slightly alkaline (pH = 7.3 to 7.5)		

#### (i) Blood

Blood is a **fluid connective tissue**. It is red, sticky and viscous fluid flowing in blood vessels. It forms 6-10% of total body weight. An adult human contains approximately 5-6 litres of blood. Blood is composed of two parts

- (i) Blood plasma (fluid part)
- (ii) Blood corpuscles (Solid or cellular part)

#### • Properties of blood

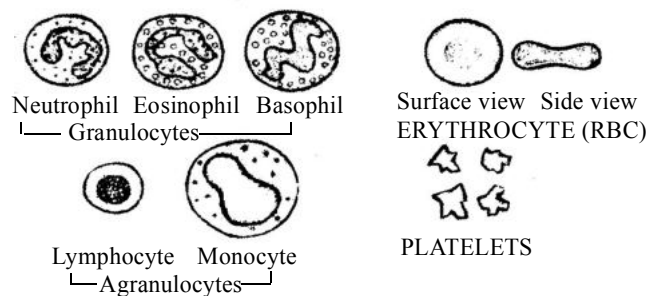
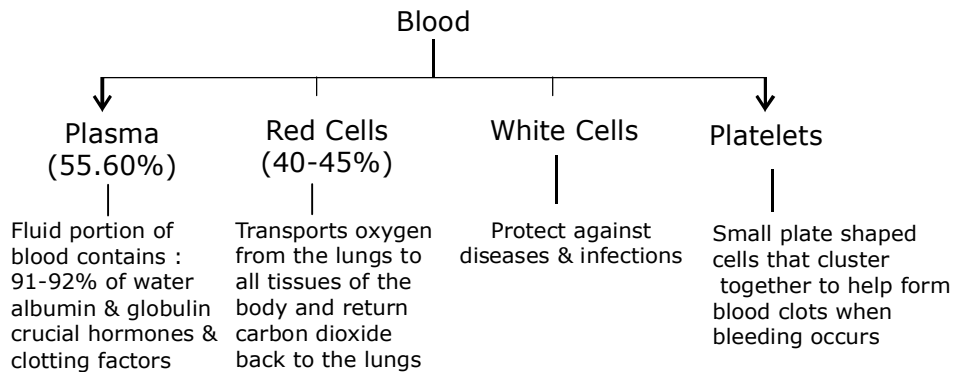
- (i) In all chordates and in annelids amongst the non-chordates, blood is a bright red fluid of salty taste and peculiar smell.
- (ii) Blood flows in a continuous circuit of blood vessels.



• **Composition of blood**

Blood consists of four parts, each with its own job in the body.

- (i) Plasma
- (ii) Red Blood cells (erythrocytes)
- (iii) White Blood cells
- (iv) Platelets



**Fig. 1 Different types of blood cells in man**

**A Little further 3.1**

Why blood doesnot clot inside a blood vessel?

**Explanation**

In the blood plasma, the basophil cells secrete heparin, which is an anti clotting chemical.

• **Functions of Blood**

Blood performs the following functions :

**(i) Transport of Oxygen**

Red blood corpuscles contain haemoglobin that combines with oxygen to form oxyhaemoglobin which is transported to the tissues of the body for the purpose of respiration.

**(ii) Transport of Carbon dioxide**

Carbon dioxide produced by the tissues as a result of respiration is transported by the blood plasma and also by the haemoglobin to the lungs from where it is removed,

**(iii) Transport of Nutrients**

The digested and absorbed nutrients like glucose, amino acids, fatty acids, vitamins, etc. are first transported to the liver and then to the whole of tissues for their storage, oxidation and synthesis to new substances.

**(iv) Transport of Excretory Products**

Nitrogenous wastes like ammonia, urea and uric acid of body are transported to the kidneys from where they are eliminated by the blood.



**(v) Regulation of Body Temperature**

The blood flows in all parts of the body, so it equalises the body temperature. It carries heat produced from one place to another place of the body.

**(vi) Maintenance of pH**

The plasma proteins act as buffer system and maintain required pH of the body tissues.

**(vii) Transport of Hormones**

The plasma of blood transports various hormones from one region to another and bring about the co-ordination in the working of the body.

**(viii) Water Balance**

The blood maintains water balance to constant level by distributing uniformly over the body.

**(ix) Protection from Diseases**

The WBC (eosinophils, neutrophils, monocytes) engulf the bacteria and other disease causing organisms by phagocytosis. The lymphocytes produce antibodies against the invading antigens.



**(x) Clotting of Blood**

Blood forms a clot at the site of injury, thus preventing further loss of blood. Blood helps in rapid healing of wounds.

**MECHANISM OF BLOOD CLOTTING (COAGULATION)**

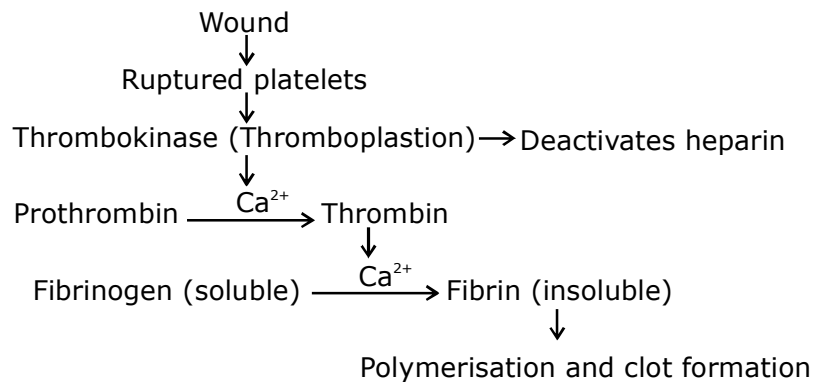
Sealing off a leaking blood vessel to stop bleeding is called **blood clotting** or **haemostatic mechanism**. A small leakage is sealed by blood platelets which adhere together to form a sticky plug called **thrombus** and the complete process is called the **agglutination of the platelets**. This process was discovered by physiologist **Howell**. He suggested that this mechanism is a complex process consisting of three steps which are as follows.

- Step-1** Formation of enzyme **thrombokinase** (or thromboplastin) by the injured tissue cells and platelets
- Step-2** The enzyme deactivates heparin (natural anti-coagulant found in blood) in the presence of calcium ions ( $\text{Ca}^{2+}$ ). Heparin changes blood into 'sol'. Thrombokinase converts plasma protein **prothrombin** (formed in liver) into **thrombin**.
- Step-3** Thrombin acts as an enzyme and converts soluble **fibrinogen** into insoluble **fibrin** which undergoes quick polymerisation and forms long fibrin threads. The fibrin threads form the clot which entraps RBCs.

	<b>ON YOUR TIPS</b>	
<b>Haemoglobin</b> is an iron-containing respiratory pigment. It is a complex globular haem protein which consists of an iron (Fe) compound conjugated to a protein.		

This process takes 2 to 8 minutes and produces a '**red clot**' at the wound site. After clot formation, bleeding stops. Now, the clot begins to contract and produces a pale-yellow fluid (serum) which is blood plasma without corpuscles and fibrinogen.

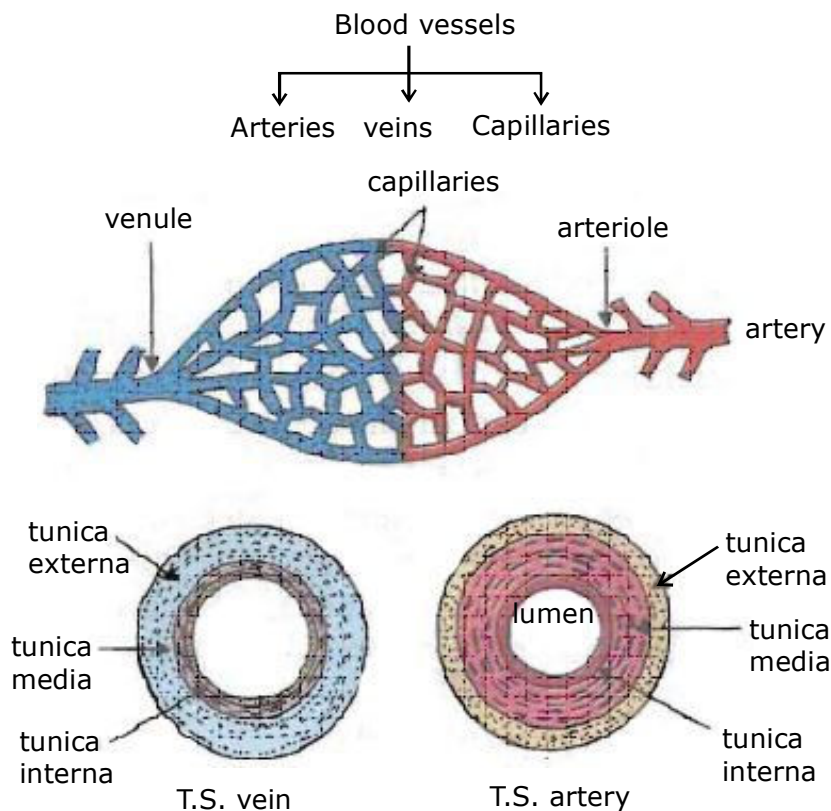




**Fig. 2 Mechanism of blood clotting**

## (ii) Blood Vessels

Blood vessels are the network of hollow muscular tubes that transport blood throughout the body. They are mainly of three types



**Fig. 3 Blood vessels**

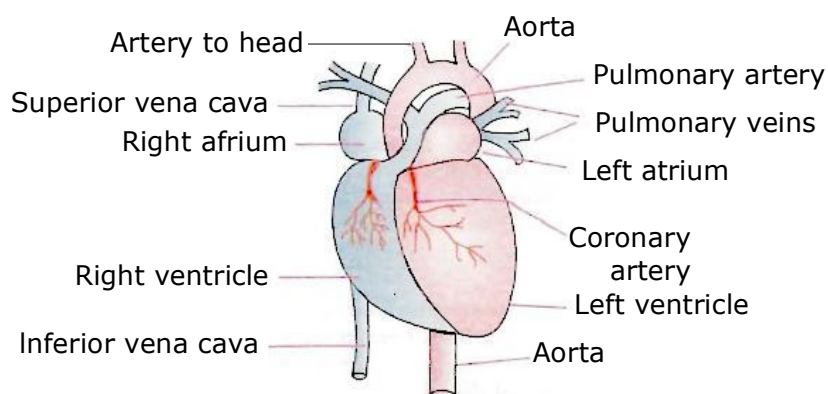
	<b>ON YOUR TIPS</b>	
If all the arteries, veins and capillaries of a person are joined end to end, the length would be equivalent to more than 1,00,000 km and could stretch around the earth about two and a half times.		

1. In humans, which type of circulation system is found?
2. Name the blood vessel that carry blood back to the heart from lungs.
3. Give the name of nucleated blood cells.

The major differences between various blood vessels have been given in Table.

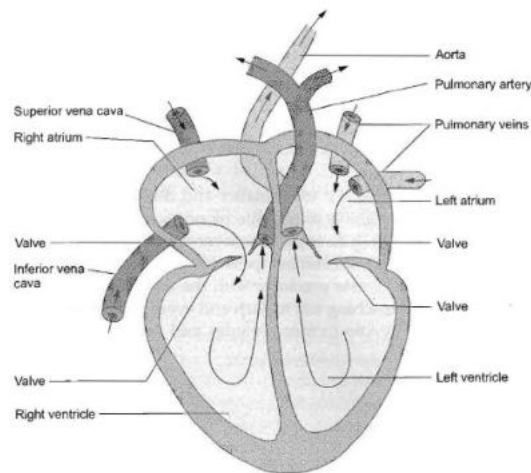
Comparative Study of Blood Vessels				
S.No.	Features	Arteries	Veins	Capillaries
1	Direction of blood flow	Take the blood away from heart to different parts of body	Bring the blood towards the heart from various body parts.	Blood flows from arterioles (capillaries) to venules
2	Kind of blood	Oxygenated blood except in pulmonary artery.	Deoxygenated blood except in pulmonary vein	Blood changes from oxygenated to deoxygenated.
3	Blood pressure	Pressure is high	Pressure is low.	Pressure is extremely low
4	Blood flow	Blood flows rapidly with jerks.	Blood flows smoothly without jerks.	Blood flows smoothly without jerks.
5	Lumen	Narrow	Wide	Very small
6	Semilunar valves	Absent	Present	Absent
7	Location	Mostly deep seated.	Mostly superficial.	Form a network all over the body and in the organs.

### (iii) Heart



**Fig. 4 External View of Human Heart**





**Fig. 5 Internal structure of the human heart**

**Size** – 5 × 3.5 inches

**Colour** – Pink

**Shape** – Conical shape

**Weight** – 300 gm.

### STRUCTURE OF HEART

The basic structure of the heart (illustrated below) may be described as follows:

The Heart is divided into separate right and left sections by the interventricular septum, or "septum" when the context is clearly that of the heart. Each of these (right and left) sections is also divided into upper and lower compartment known as atria and ventricles, respectively.

The four main chambers of the heart are :

**Right Atrium**

**Right Ventricle**

**Left Atrium**

**Left Ventricle**

It is essential that blood flows in the correct direction through the heart so the structure of the heart includes a series of valves

The **Tricuspid valve** separates the right atrium from the right ventricle.

The **Pulmonic/Pulmonary valve** separates the right ventricle from the pulmonary artery.

The **Mitral (also known as the Bicuspid) valve** separates the left atrium from the left ventricle.

The **Aortic valve** separates the right ventricle from the ascending aorta.

### PRACTICE ZONE

3.1

1. Two types of circulatory system exists in animals open closed. In humans & most of other animals closed circulatory system is found, where blood is flowing in blood vessels.
2. Pulmonary vein.
3. White blood cells.

### A Little further 3.1

Why do ventricles have thicker muscular walls than the atria?

#### Explanation

Since ventricles have to pump blood into various organs of the body, therefore they have thicker muscular wall than atria.



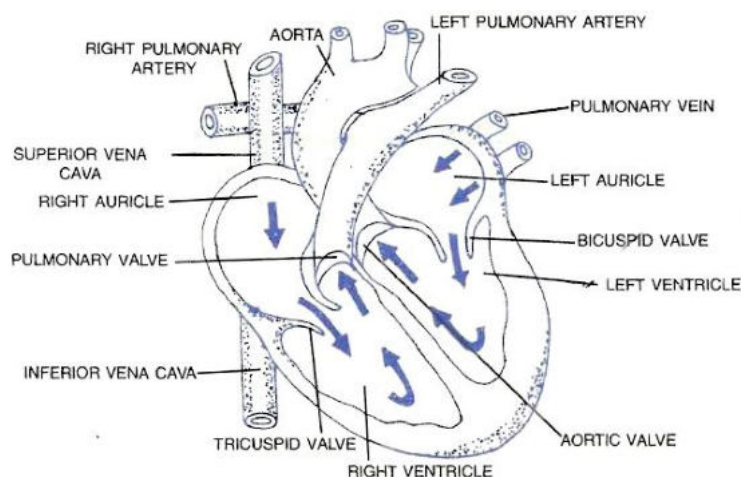
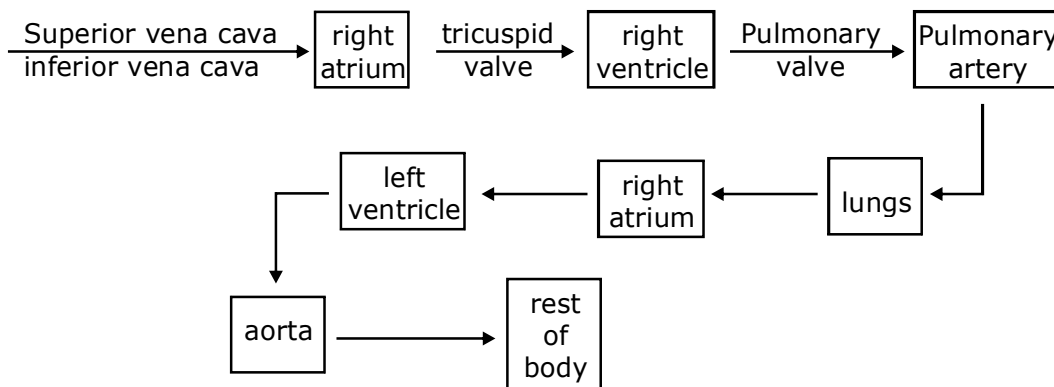


## WORKING OF HEART/ PHYSIOLOGY OF HEART

Heart does not work throughout the day. It rests double the time it works. It rests between every beat. The resting period is called **diastole**, its duration is twice as long as that of **systole**, which is the period of muscular contraction. The series of events which occur during one complete beat of the heart is known as **cardiac cycle**. Cardiac cycle mainly consists of three steps, i.e., Auricular systole, Ventricular systole and Joint diastole.

Contraction of the two auricles is simultaneous and is called **auricular systole**, relaxation of the auricles is called **auricular diastole**. Similary **ventricular systole** is the simultaneous contraction of two ventricles and **ventricular diastole** is their relaxation. Cardiac cycle occurs in the following steps:

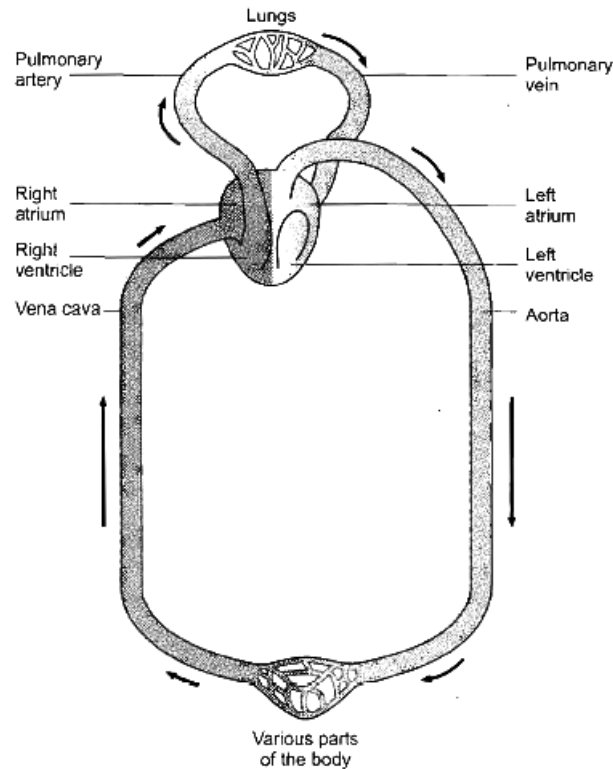
1. In the beginning, both auricles and ventricles are in a joint diastole.
2. Blood flows into the left auricle from the pulmonary veins and from superior and inferior vena cavae in the right auricle.
3. Next step is of auricular systole in which both auricles contract simultaneously which drives most of their blood into their respective. At this stage ventricles are in diastole i.e., they are relaxed.
4. Ventricular systole follows immediately. Pressure of the blood in the ventricles forces to close the bicuspid and tricuspid valves.



**Fig. 6 Working of heart**

5. The first sound "**Lubb**" is produced when the auriculo-ventricular valves get closed at the start of ventricular systole.
6. Pressure in the ventricles leads to the pressing of the semi-lunar valves of the great arteries (i.e., aorta and pulmonary artery), and thus driving the blood into them. The second sound "**Dupp**" is produced when the semi-lunar valves of aorta and pulmonary artery get closed.
7. After this ventricles get relaxed or there is ventricular diastole. The auricles are still undergoing diastole. Thus we can say, all chambers are in diastole or relaxed. One cardiac cycle is completed in 0.8 second.





**Fig. 7 Route of blood circulation**

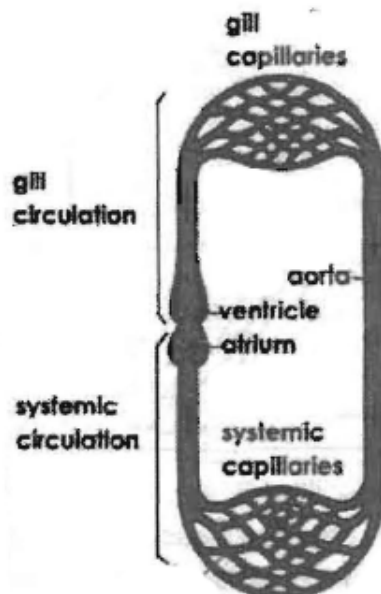
PRACTICE ZONE

3.2

1. What is the function of valves in the circulatory system?
2. How does lymph differ from blood?
3. The blood comes inside the veins its pressure is quite low. What, then, keeps the blood flowing through the veins?

• **Single Circulation**

In fishes, the blood flows through the heart only once while completing the full circuit of the body. It is called single circulation. The heart receives and pumps only venous blood. It reaches to heart on deoxygenation.



**Fig. 8 Single circulation in fish**

**A Little further 3.3**

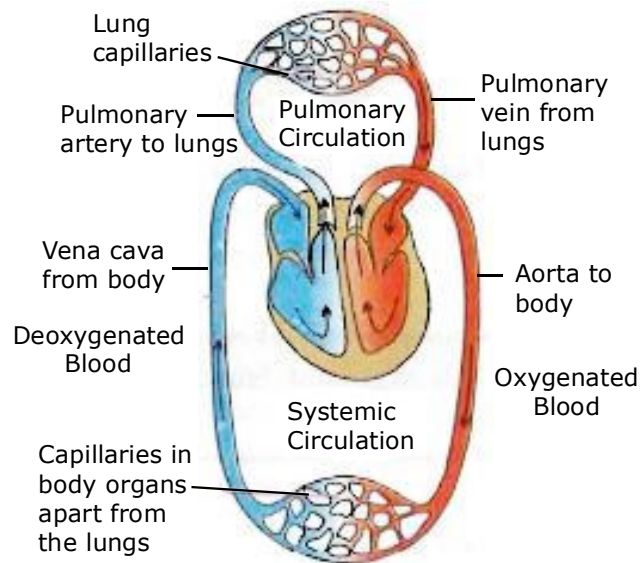
Human heart remains functional even after death. Explain.

**Explanation**

The heart does continue to beat for many hours if kept in a nutritive, oxygenated fluid because the contractions of cardiac muscle begin with the muscle itself & can occur independently of any nerve supply

**• Double Circulation**

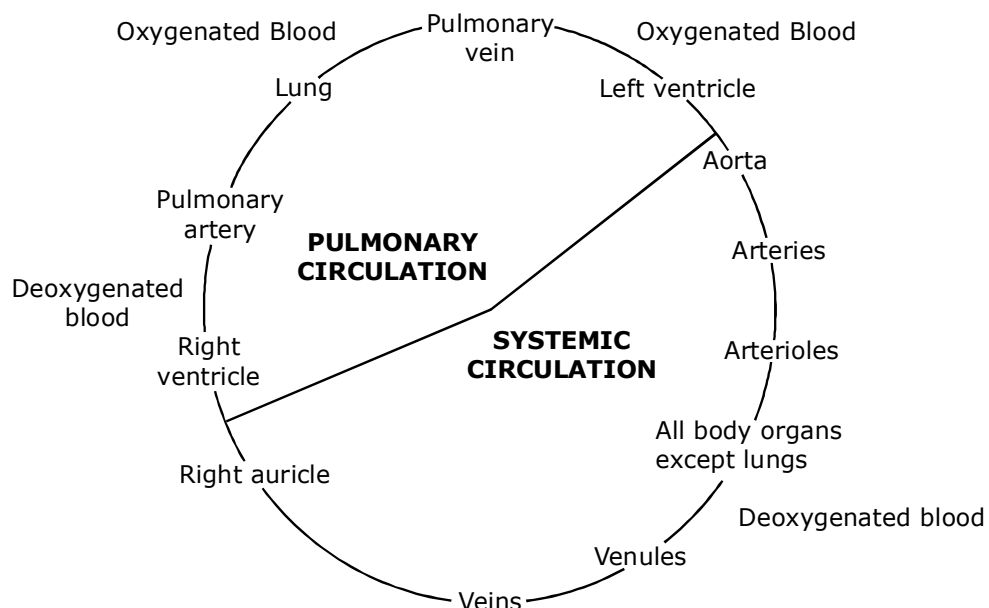
It is passage of the same blood twice through the heart first one the right side, then on the left side in order to complete one cycle. Double circulation has two components, pulmonary circulation and systemic circulation.



**Fig. 9 Double circulation in mammals and birds**

**(i) Pulmonary circulation**



It is movement of blood from heart to the lung and back. Deoxygenated blood of the body enters the right auricle, passes into right ventricle which pumps it into pulmonary arch. With the help of two separate pulmonary arteries the blood passes into the lungs. Here, it is oxygenated. Oxygenated blood comes back to left auricle of heart through four pulmonary veins, two from each lung.



**Fig. 10 Double circulation of blood in man**

**(ii) Systemic Circulation**

It is the circulation of blood between heart and different parts of the body except lungs. Oxygenated blood received by left auricle passes into left ventricle. The left ventricle pumps it into aorta for supply to different body part including walls of the heart by means of arteries. Inside the organs the blood loses oxygen and nutrients. It picks up carbon dioxide and waste products. This deoxygenated blood is drained by veins and sent to the right auricle of heart.

	<b>ON YOUR TIPS</b>	
The average adult heart pumps approximately 5 liters of blood per minute		

## PRACTICE ZONE

3.2

1. To prevent blood from flowing backward, the heart is equipped with valves that close automatically.
2. Lymph is white vascular tissue that consists of blood lacking RBC, platelets and some blood proteins.
3. Breathing and other forms of muscular activity contribute to venous blood flow.

**DIFFERENCES BETWEEN PULMONARY CIRCULATION AND SYSTEMIC CIRCULATION**

Pulmonary Circulation	Systemic Circulation
<b>1. Distance.</b> It operates through short distance.	It operates through long distance.
<b>2. Flow.</b> It is from heart to lungs and back.	It is from heart to body parts (Other than lungs) and back.
<b>3. Pumping Blood.</b> is pumped by right ventricle and received by left auricle.	Blood is pumped by left ventricle and received by right auricle.
<b>4. Oxygenation- Deoxygenation.</b> Deoxygenated blood is pumped into lungs. Oxygenated blood is received from lungs.	Oxygenated blood is pumped into different body parts (other than lungs). Deoxygenated blood is received from body organs.

**A Little further 3.4**

What is the advantage of having four chambered heart?

**Explanation**

Four chambered heart ensures complete separation of oxygenated and deoxygenated bloods, which is useful to animals with high energy needs (due to thermoregulation and higher activity) such as birds and mammals.



## BLOOD PRESSURE

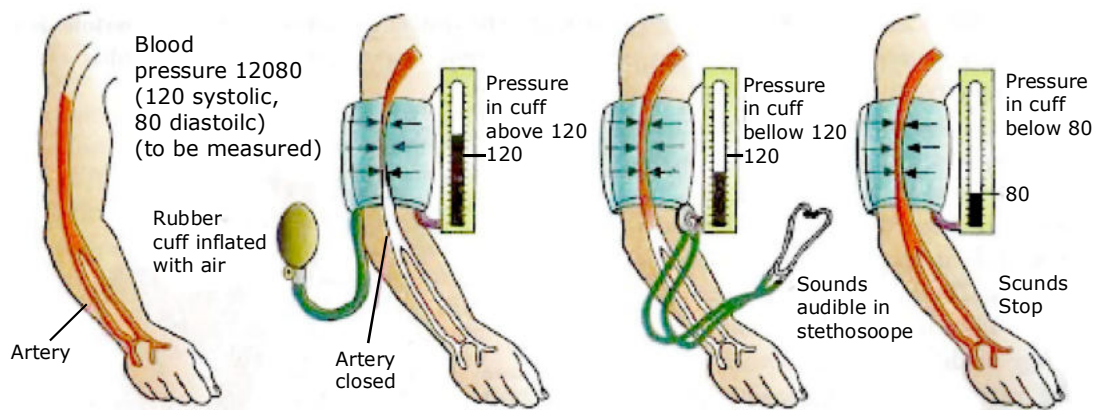


Fig. 11 Measurement of Blood Pressure

**Blood pressure is the pressure exerted by the blood on the walls of vessels (arteries).** The blood pressure is always expressed in form of two values called systolic pressure and diastolic pressure. **The temporary rise in blood pressure during contraction of the heart is called systolic pressure. The temporary fall in blood pressure during relaxation of the heart is called diastolic pressure.** The blood pressure inside the arteries is much more in comparison to that inside veins.

In humans, the **systolic pressure** is about 120 mm of Hg whereas diastolic pressure is about 80 mm of Hg. The blood pressure under **normal conditions** is thus 120/80 mm of Hg. It varies from person to person and from time to time. It also varies with age.

A persistent increase in blood pressure is called **hypertension** or high blood pressure. It is caused by narrowing of arteries which results in increased resistance to blood flow. A lower systolic or diastolic pressure is known as **hypotension** (low blood pressure). Blood pressure is measured by using an instrument called **sphygmomanometer**.

	<b>ON YOUR TIPS</b>	
The blood supply to brain stops due to rupturing blood vessels. This may cause permanent damage to brain and even death		

### • Pulse

Due to beating of heart, the blood enters into the arteries forcefully due to which artery expands a little. **Pulse is the expansion of an artery each time the blood enters into it.** Each heartbeat produces one pulse. Thus, the pulse rate is similar to heartbeats/minute, i.e., the pulse rate of a person is 70-72 per minute while resting. During exercise or any physical activity the pulse rate increases. Due to deeply-seated arteries, pulse cannot be felt everywhere except certain places like wrists, temple and neck where they are close to skin.

## THE LYMPHATIC SYSTEM

Lymphatic system is another circulatory system in human body which transports materials through circulating fluid called lymph.

The lymphatic system consists of the following parts.

- (i) Lymph
- (ii) Lymph capillaries
- (iii) Lymph vessels
- (iv) Lymph nodes (or glands)

### (i) Lymph

Lymph is a straw-coloured or light yellow coloured fluid connective tissue. It is translucent alkaline fluid present in the lymph vessels. It is formed of two parts, i.e., plasma and lymphocytes.

### (ii) Lymph capillaries

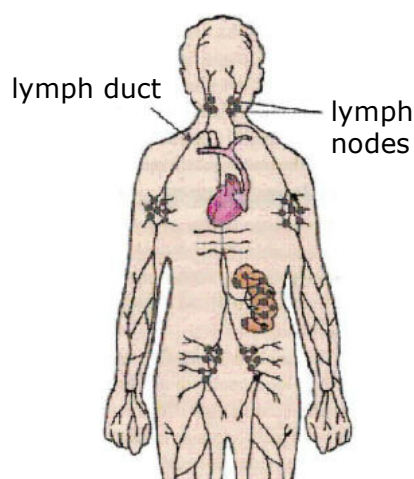
Lymph drains into lymphatic capillaries (or lymph capillaries) which are thin-walled, highly permeable tubes that form a network in every organ except nervous system.

### (iii) Lymph vessels

The lymphatic capillaries unite to form lymph vessels which are small vessels with numerous valves. The lymph vessels are like veins but they have comparatively thin wall and numerous valves.

### (iv) Lymph nodes

At places, lymph vessels bear swellings called lymph nodes or lymph glands. They are the site where lymphocytes accumulate and produce antibodies. As lymph nodes are rich in lymphocytes, they filter out germs and foreign particles from lymph. Lymph nodes are abundant in the regions of neck, armpit and groin. Tonsils and adenoids are masses of lymphatic tissues.



**Fig. 12 Lymphatic System in human**

### • Functions of lymphatic system

- (i) The volume of blood decreases due to filtration of blood plasma from blood capillaries. Lymph collects this excess fluid and drains it back into the blood, thus, maintains the volume of blood.
- (ii) It acts as a connecting link between blood and the body cells and helps in exchange of materials between them.
- (iii) Lymph capillaries (lacteals) of intestinal villi help in absorption of fat and transport of the same to the blood.
- (iv) It protects the body by killing the germs with the help of lymphocytes. Thus, develops immunity of the body.
- (v) Various tissue secretions like hormones, macromolecules, plasma proteins are first added to lymph which passes it to the blood.
- (vi) It collects carbon dioxide, waste products and metabolites from tissues via tissue fluid and passes to blood.





## DIFFERENCES BETWEEN BLOOD AND LYMPH

S.No.	Parameter	Blood	Lymph
1	Colour	It is red in colour due to the presence of haemoglobin in RBCs.	It is colourless or light-yellow in colour
2	Composition	It contains blood plasma and blood cells (RBCs, WBCs and platelets).	It contains plasma and lymphocytes.
3	Direction of flow	Blood flow is bidirectional (from heart to organs and organs to heart)	Lymph flow is unidirectional (from tissues to veins).
4	Speed of flow	Blood flows rapidly.	Lymph flows slowly.
5	Functions	It transports materials like gases, nutrients and hormones from one organ to another organ.	It functions like a connecting link between blood and tissues.

## PRACTICE ZONE

3.3

1. Name the part through which the transportation of food materials is carried out by in plants
2. Define translocation.
3. How is water absorbed by the roots of plants ?

## TRANSPORTATION IN PLANTS

Unlike animals, some materials pass in and out of plants through **diffusion**. For gaseous diffusion to occur, the plants possess stomata and lenticels. During the daytime the photosynthetic organs obtain carbon dioxide from outside by diffusion. The same is used for synthesis of food. Oxygen is released as a by-product. It passes out of the plant by diffusion. Simultaneously, a lot of water vapours pass out.

Other materials required for building plant body are obtained from soil, e.g., nitrogen, phosphorus, other minerals, water. They are sent to chlorophyll containing organs where food is manufactured. The manufactured food is passed to all parts for utilisation and storage. If the distance between the two is small, the materials reach there by diffusion.

If the distance is large, as in most plants, they have to be transported through a proper system of transportation. However, plants have a large proportion of dead cells. They do not move. Therefore, they have low energy needs. The transport systems are slow. Further, there are two independent pathways having conducting tubes.

One is xylem that moves water and minerals from soil to aerial parts. The other is phloem which carries food and hormones from the region of availability (e.g., leaves, storage organs) to the areas of utilisation (all living cells, growing points, storage organs, developing fruits).

ON  
YOUR  
TIPS

Tracheids are conducting elements of non-flowering plants. Vessels occur mostly in angiosperms where they form the main conducting elements. The number of tracheids is small in angiosperms.

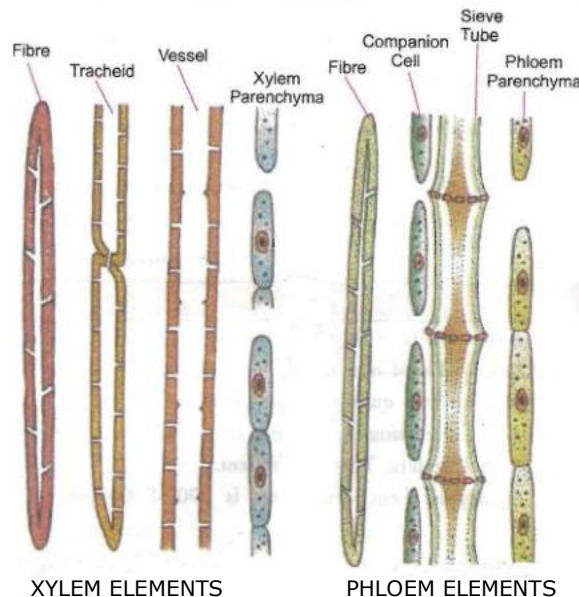


• **XYLEM**

It is a complex tissue which transports sap (water and minerals). Xylem has four types of cells.

1. Xylem fibres
2. Xylem parenchyma
3. Tracheids
4. Vessels

Only xylem parenchyma are living cells. Others are dead, empty and lignified. Vessels and tracheids are called **tracheary elements** because they take part in transport of sap (water + minerals). Vessels are long multicellular tubes which are formed by end to end union of several cells in which cross walls have broken down. Tracheids are elongated cells with pointed ends. Both the tracheary elements have pits or other thin unlignified areas for element to element movement of water. Xylem parenchyma takes part in lateral flow of water.



**Fig. 13 Xylem and phloem elements**

• **PHLOEM**

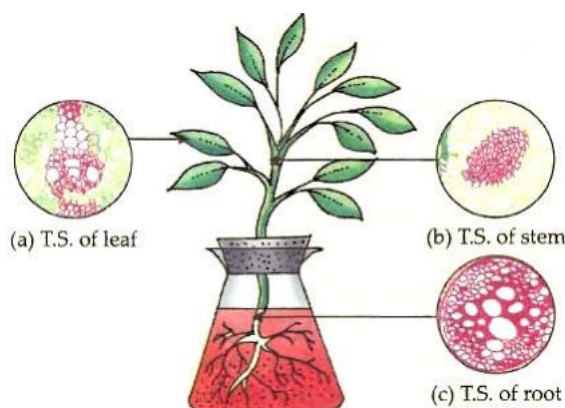
It is complex tissue which takes part in transport of food. Phloem has four types of cells —

1. Sieve tubes
2. Companion cells
3. Phloem parenchyma
4. Phloem fibres.

Only phloem fibres are dead cells. Others are living cells. Sieve tubes are conducting channels of phloem. They are elongated multicellular tubular channels formed by end to end union of numerous sieve tube elements. The end walls or septa between adjacent sieve tube elements are bulged out and have pores. They are called **sieve plates**. Sieve tube elements do not have a nucleus. Their functioning is controlled by adjacent nucleated companion cells.



## Activity-3.1

**SCIENCE COMES ALIVE****To show that xylem conducts water in plants****Fig. 14 Ascent of sap takes place through xylem****Apparatus**

Conical flask, red dye, a small plant, microscope

**Procedure**

Dissolve red dye in a conical flask to get red colour water. Put a plant, which has a soft stem, in the conical flask. Leave the set-up for about half an hour. Now, take out the stem and cut a thin section. Also, prepare transverse sections of leaf and root. Observe the prepared slides under the microscope.

**Observation**

The portion of the vascular tissues which contains xylem is stained red.

**Conclusion**

Xylem conducts water from roots of other aerial parts of plant via xylem.

**TRANSPIRATION**

(L. *trans*-across, *spirate*-to breathe)

Transpiration is loss of water in vapour form from the exposed parts of a plant. Aerial parts of the plants are always losing water through transpiration.

	<b>ON YOUR TIPS</b>	
<p>Nearly 98-99% of water absorbed by a plant is lost through transpiration. Most of the transpiration occurs through leaves and very young stems.</p>		

**A Little further 3.5**

Plants have low energy needs as compared to animals. Explain

**Explanation**

Plants are anchored. They do not move about. Most of their body is made of dead cells and cell walls. Therefore, their requirement of energy is quite low as compared to animals.

## Activity-3.2



**SCIENCE COMES ALIVE****Demonstration of Transpiration****Apparatus**

A small potted plant, a small pot of the same size and same amount of soil as that of potted plant, a stick of the height of the plant, plastic sheets.

**Procedure**

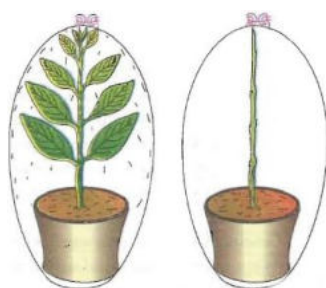
Cover the soil of two pots with plastic sheets. Fix a stick in the middle of the pot which does not bear the plant. Cover both the pots with plastic sheets and place them in bright sunlight for half an hour.

**Observation**

The internal surface of the plastic sheet belonging to the set having potted plant becomes wet. There is no such change in the second set.

**Conclusion**

The wetness of the plastic sheet must have occurred due to condensation of water vapours. Water vapours can come only from aerial shoot of the potted plant. The soil does not lose any water in evaporation as it is clear from the second set. Loss of water aerial parts of the plant in vapour form is called transpiration.



**Fig. 15 Demonstration of transpiration**

## PRACTICE ZONE

3.3

1. Phloem
2. The transportation of organic solutes in the plants is called translocation.
3. Water and minerals are absorbed from the soil by roots and then transported to various parts of the plants like stem, leaves and flowers. The water and dissolved minerals are absorbed through root hair. They also increase the surface area for absorption. From the root hair, the absorbed water moves through root cortex, endodermis, pericycle and finally into the xylem elements through **osmosis**.

**• Functions of transpiration****(i) Cooling**

Evaporation of water from the aerial parts results in lowering of their temperature which will otherwise rise due to exposure to sun.

**(ii) Concentration of Minerals**

Transpiration helps in increasing concentration of minerals present in rising water.

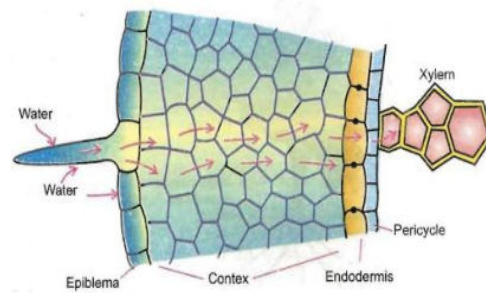
**(iii) Transport**

It helps in transport of water and minerals.

	<b>ON YOUR TIPS</b>	
<p>The succulent plants retain water in their fleshy body by reducing transpiration. It helps the plants to survive in high temperature and high sunlight.</p>		



## TRANSPORT OF WATER AND MINERALS



**Fig. 16 Absorption of soil water by roots**

There is a continuous system of dead conducting channels (vessels and tracheids) from near the root tips to leaves and shoot tips. It transports water and minerals. The two are obtained from soil by the roots. The various steps involved in transport of water and minerals are as follows :

### 1. Mineral absorption

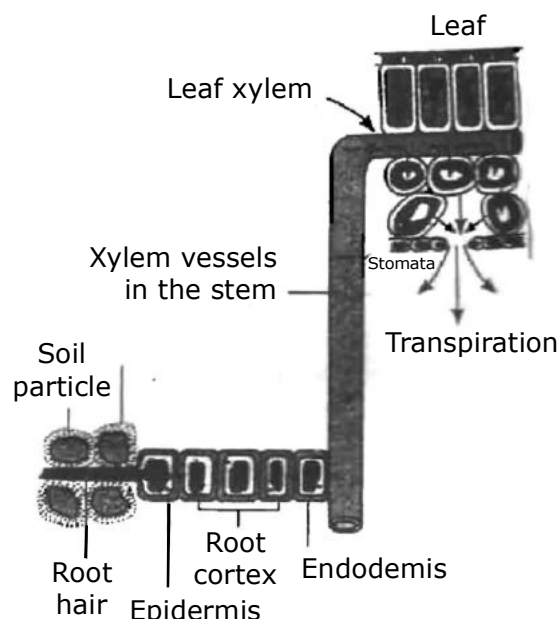
It occurs in the growing parts of the root. Both the surface or epiblema cells as well as root hairs take part in mineral absorption. Mineral absorption is an active process which involves expenditure of energy. Active absorption creates a higher concentration of minerals in the root as compared to soil solution.

### 2. Absorption of water

Root hair zone is the region of water absorption. The inside of the root has higher osmotic concentration than the soil solution. Root hairs are in contact with soil interspaces having capillary water. The root hairs pick up water which is transferred inwardly due to still higher osmotic concentration. It reaches the cells surrounding the xylem channel. Salts accumulated in the basal part of xylem channel cause osmotic entry of water into xylem and form column of water. It also creates a positive pressure known as **root pressure**. This is, however, unable to push water to any great height. Root pressure is often absent, atleast during the day time. Its effect becomes important at night.

### 3. Ascent of sap

It is upward movement of absorbed water or sap from root to the top of the plant. The mechanism of ascent of sap was given by Dixon and Joly (1894). It is called transpiration pull or **cohesion-tension theory** of ascent of sap. The force for ascent of sap lies in the aerial parts. Here mesophyll and other cells lose water to outside air through transpiration which produces a negative pressure.



**Fig. 17 diagrammatic representation of ascent of sap**



**A Little further 3.6**

Give the function of guard cells in transpiration

**Explanation**

Guard cells regulate the rate of transpiration. The rate of transpiration is regulated by the regulation of size of stomatal pore which is brought by changes in the turgor pressure of guard cells surrounding the stomatal pore (stoma).

**DEVELOPMENT OF NEGATIVE PRESSURE**

Loss of water by mesophyll cells increases their suction pressure. They withdraw water from the xylem channels. As there are billions of mesophyll cells withdrawing water from xylem channels, water column present in the xylem comes under tension or negative pressure.

Its value is 10-20 atmospheres. Water column does not break due to two forces:

**(a) Cohesion force** among the water molecules.

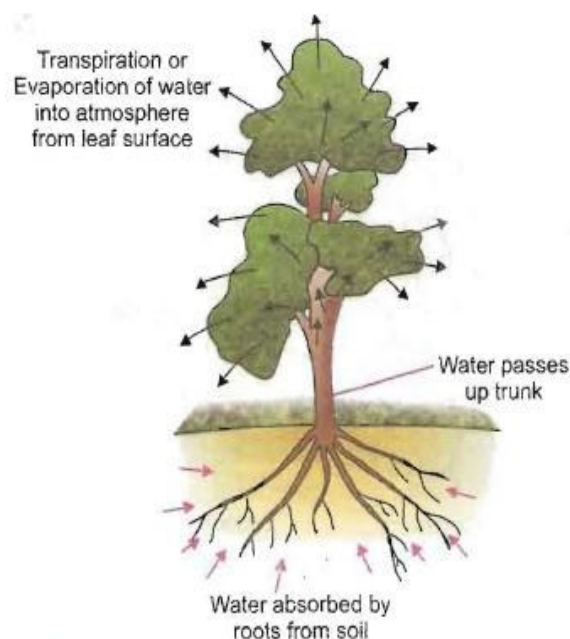
**(b) Adhesion force** between water molecules and wall of the xylem channels.

**Rise of Water**

Tension or negative pressure of the water column results in its upward pull just as cold drink is sucked with the help of a straw pipe. Since it develops due to transpiration, it is called transpiration pull.

**TRANSLOCATION OR TRANSPORT OF FOOD AND OTHER SUBSTANCES**

Food materials are translocated from the region of their manufacture or storage to the region of their utilisation.



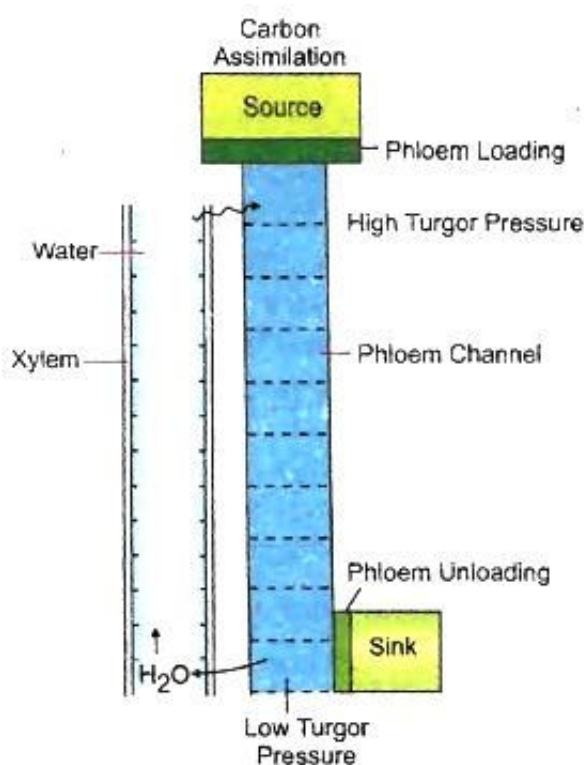
**Fig. 18 Transpiration or evaporation of water from aerial surface causing absorption and ascent of sap**

The region of supply of food is called source while the area of utilisation is called sink. The direction of translocation can be downward, upward or both. The food manufactured by leaves passes into the storage region and other sinks in the downward direction as well as towards growing points and developing fruits in the upward direction. In spring season, the stored food present in root and stem is translocated upwardly to buds for their growth.

The translocating nutrients consist of soluble carbohydrates (mostly sucrose), amino acids, organic acids, hormones and other organic solutes.

Translocation occurs through phloem. The channels of transport are sieve tubes (sieve cells in non-flowering plants). Sieve tubes are specialised for this purpose. They are devoid of nuclei and internal membranes. The cytoplasm of one tube cell is continuous with that of adjacent sieve tube cells through sieve plates. The translocation activity of sieve tubes is controlled by companion cells which lie adjacent to sieve tube cells.

### MECHANISM OF PHLOEM TRANSPORT



**Fig. 19 Translocation of organic solutes as per mass flow hypothesis**

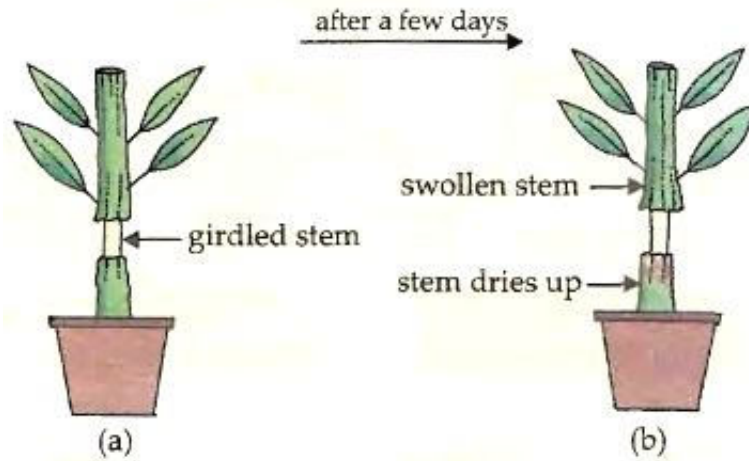
The transport of organic solutes or nutrients occurs through a physical process but entry and exit of nutrients from the phloem can occur only through an active process which utilises energy from ATP. With the help of energy, food materials pass into the phloem from the region of manufacture or storage (source end). After entering the sieve tubes the nutrients being in high concentration, exert an osmotic pressure which causes entry of water into this region. A high turgor pressure develops. It forces the nutrients to pass towards the regions which have low turgor pressure. The movement is like a **mass flow** (Munch 1930). Low turgor pressure is maintained in the area where being withdrawn for consumption (growing points) or storage (root, stem, fruits) by an active process.



## Activity-3.3

**SCIENCE COMES ALIVE**

**To show phloem transports food prepared by leaves**



**Fig. 20 Phloem transports food**

**Apparatus**

A potted plant and a razor blade.

**Procedure**

Take a potted plant with a thick stem. Carefully remove the bark of the stem with the help of a razor blade. This is known as girdling of stem. Leave the plant in sunlight for a few days and observe the girdled part carefully.

**Observation**

The part of the stem above the girdle shows swelling, while the lower portion dries up.

Girdling of stem removed the phloem tissues of the stem. As a result, the food prepared by the leaves could not be translocated below the girdled part of the stem. Therefore, the food got collected above the girdle, resulting in swollen stem. The portion below the girdle dries up due to the lack of food.

**Conclusion**

Phloem transports food prepared by the leaves to different parts of the plant body.

## N.C.E.R.T TEXT BOOK SOLUTION

**Q.1** What are the components of the transport system in human beings? What are the functions of these components?

**Ans.** The major components of human transport system are blood vascular system and lymphatic system.

**Blood vascular system :** It consists blood, blood vessels and heart.

**(a) Heart :** Main pumping organ which provides necessary force for circulation of blood.

**(b) Blood vessels :** Used for transportation of materials.

- (i) Arteries: They carry oxygenated blood from heart to various parts of the body.
- (ii) Veins: They carry deoxygenated blood from various body parts to heart.
- (iii) Capillaries: They allow the exchange of materials between blood and body tissues.

**(c) Blood:** Fluid which carry nutrients, gases ( $O_2$  and  $CO_2$ ), wastes, hormones, etc. Blood cells help in transport of materials.

- (i) RBCs: Transport of oxygen and carbon dioxide as oxyhaemoglobin and carbamin haemoglobin, respectively.
- (ii) WBCs: Phagocytosis of pathogenic cells, produce antibodies and histamine.
- (iii) Blood platelets: Take part in blood clotting due to formation of thromboplastin.

**Lymphatic system :** It consists of lymph, lymph vessels and lymph nodes.

- (i) Lymph : It drains excess fluid from extracellular space back into the blood. It attracts and carries germs to lymph nodes.
- (ii) Lymph capillaries : Lymph capillaries join to form lymph vessels.
- (iii) Lymph vessels : These collect lymph and pass it to veins.
- (iv) Lymph nodes : These take part in maturation of lymphocytes and are specialised to filter germs.

**Q.2** Why is it necessary to separate oxygenated and deoxygenated blood in mammals and birds?

**Ans.** Birds and mammals need more energy for metabolism and to maintain the constant body temperature.

So, they have four-chambered heart in order to separate the oxygenated blood from deoxygenated blood completely. If it was not so, then there would have been mixing of the types of blood which would have decreased the supply of oxygen to body tissues.

**Q.3** What are the components of the transport system in highly organised plants?

**Ans.** The components of the transport system in highly organised plants are

(a) Xylem : It transports water and minerals in plants and composed of tracheids, vessels xylem fibres and xylem parenchyma.

(b) Phloem : It transports or translocates organic solutes or food in plants and consists of sieve tubes, companion cells, phloem fibres and phloem parenchyma.

**Q.4** How are water and minerals transported in plants?

**Ans.** See text.

**Q.5** How is food transported in plants?

**Ans.** See text.





**EXERCISE – I****NTSE /OLYMPIAD /FOUNDATION PROBLEMS**

- Q.1** The smallest blood vessel in the body is :  
 (A) Capillary (B) Artery (C) Vein (D) Vena cava
- Q.2** Arteries carry oxygenated blood except :  
 (A) Pulmonary (B) Cardiac (C) Hepatic (D) Systemic
- Q.3** Four chambered heart is found in :  
 (A) Cobra (B) Tortoise (C) Salamander (D) Crocodile
- Q.4** Mitral valve in mammals guards the opening between :  
 (A) Right atrium and right ventricle (B) Left atrium and left ventricle  
 (C) Right atrium and left ventricle (D) Left atrium and right ventricle
- Q.5** Tricuspid valve is present between :  
 (A) Right atrium and right ventricle (B) The two atria  
 (C) The two ventricles (D) Left atrium and left ventricle
- Q.6** Which of the following has the thickest walls ?  
 (A) Right ventricle (B) Left ventricle (C) Right auricle (D) Left auricle
- Q.7** The pacemaker of heart is :  
 (A) AV node (B) SA node (C) SV node (D) Tricuspid valve
- Q.8** Typical 'lubb-dupp' sounds heard during heartbeat are due to :  
 (A) Closing of bicuspid and tricupid valves  
 (B) Closing of semilunar valves  
 (C) Blood under pressure through aorta  
 (D) Closure of bicuspid-tricuspid valves followed by semilunar valves
- Q.9** The instrument used to hear heart sound is :  
 (A) Electrocardiograph (B) Sphygmomanometer  
 (C) Stethoscope (D) Haemometer
- Q.10** In adult man, normal BP is :  
 (A) 100/80 mm Hg (B) 120/80 mm Hg (C) 100/120 mm Hg (D) 80/120 mm Hg
- Q.11** The instrument by which BP of man is determined :  
 (A) Ultrasound (B) BP meter (C) Stethoscope (D) Sphygmomanometer





**Q.12** Mammals are said to have double circulation. It means :

- (A) Blood vessels are paired
- (B) There are two types of blood vessels attached to every organ
- (C) There are two systems, one from the heart to the lungs and back to the rest of the body
- (D) The blood circulates twice through the heart

**Q.13** Water movement against gravity is due to :

- (A) Osmosis                      (B) Respiration                      (C) Photosynthesis                      (D) Transpiration

**Q.14** The instrument used to measure transpiration is :

- (A) Barometer                      (B) Potometer                      (C) Thermometer                      (D) Potometer

### **FILL IN THE BLANKS**

1. .... is the flow of water molecules from the region of higher water potential to the region of lower water potential through a semipermeable membrane.
2. Heart is protected by a covering known as .....
3. Left auriculo-ventricular aperture is guarded by .....valve.
4. The blood pressure is measured by an instrument called .....
5. Amoebic movement of leucocytes is known as .....
6. The series of events which occur during one complete beat of the heart is known as ..... cycle.
7. The pressure wave transmitted all through the arterial system is known as .....

### **ANSWER KEY**

- |    |   |    |   |     |   |     |   |     |   |     |   |     |   |
|----|---|----|---|-----|---|-----|---|-----|---|-----|---|-----|---|
| 1. | A | 2. | A | 3.  | D | 4.  | B | 5.  | A | 6.  | B | 7.  | B |
| 8. | D | 9. | C | 10. | B | 11. | D | 12. | D | 13. | D | 14. | D |

### **FILL IN THE BLANKS**

- |    |                  |    |             |    |          |
|----|------------------|----|-------------|----|----------|
| 1. | Osmosis          | 2. | Pericardium | 3. | Bicuspid |
| 4. | Sphygmomanometer | 5. | diapedesis  | 6. | Cardiac  |
| 7. | Pulse wave       |    |             |    |          |



**EXERCISE – II****PRACTISE FOR SUMMATIVE ASSESSMENT****Very Short Answer type Question:**

- Q.1** Name the largest artery in human body.
- Q.2** What makes the red blood corpuscles (cells) red?
- Q.3** Name the type of blood vessels which carry blood from organs to the heart.
- Q.4** Name the term for transport of food from leaves to other parts of plants.
- Q.5** What process in plants is known as transpiration?
- Q.6** Name the tissue which transports soluble products of photosynthesis in a plant.
- Q.7** Name the tissue which transports water and minerals in a plant.
- Q.8** Name the component of blood that helps in the formation of blood clot in the event of a cut.
- Q.9** Name the process in plants where water is lost as water vapour.
- Q.10** What is translocation in plants?

**Short Answer type Question :**

- Q.1** Which mechanism plays an important role in transportation of water in plants (a) During daytime (b) At night ?
- Q.2** Give reasons for the following : (a) Why is diffusion not sufficient to meet oxygen requirement of all the cells in multicellular organisms ?
- Q.3** What is translocation ? How does it take place in plants ?
- Q.4** State two differences between arteries and veins.
- Q.5** Leakage of blood from vessels reduces the efficiency of pumping system. How is leakage prevented?

**Long Answer type Question :**

- Q.1** Explain two type of circulation in man.
- Q.10** (i) Name the blood vessel that brings oxygenated blood to the human heart.  
(ii) Which chamber of human heart receives oxygenated blood?  
(iii) Explain how oxygenated blood from this chamber is sent to all parts of the body.



## 4. EXCRETION



*The biological process of removal of harmful nitrogenous wastes from the body is called excretion.*

### INTRODUCTION

During cellular respiration, various metabolic reactions occur in the body leading to formation of various waste products such as carbon dioxide, urea, etc. These waste products are harmful if they are allowed to accumulate in the body. Therefore removal of these waste products is must. The process of removal of these metabolic wastes from the body is known as **excretion**. The process of maintaining the right amount of water and ionic balance is called **osmoregulation**.

### Singnificance of excretion

- (i) The unwanted by-products of the metabolic of the metabolic activities are removed.
- (ii) Many toxic chemicals, which damage the cells and affect metabolic activities, are removed.
- (iii) The ionic concentration of body fluids is maintained by excretion and osmoregulation.
- (iii) The water content and pH of body fluids is regulated by it.

### EXCRETION IN ANIMALS

In animals principal wastes produced by various metabolic activities are nitrogenous substances like ammonia, urea and uric acid along with respiratory wastes ( $\text{CO}_2$ ) and others.

Animals	Amoeba	Hydra	Flatworm	Earthworm	Insects e.g. cockroach	All Chordates
Excretory Structures	Cellular surface	Body surface	Protonephridia (flame cells)	Nephridia	Malpighian tubules	Kidneys
Waste products	$\text{CO}_2$ and ammonia	$\text{CO}_2$ and ammonia	Mainly ammonia	ammonia and urea	Uric acid	Urea

#### A Little further 4.1

How does skin helps in the regulation of body temperature?

#### Explanation

The thin layer of fat cells in the dermis of the skin insulates the body. Contraction of smooth muscles attached to hairs forms goosebumps and creates an insulting blanket of warm air. Also, sweat produced by sweat glands uses excess body heat to evaporate, providing a cooling effect.



## **EXCRETION IN HUMAN (Human Excretory System)**

In human beings excretion mainly occurs through a urinary system.

Urinary or excretory system consists of

- (1) The kidneys
- (2) The ureters
- (3) The urinary bladder
- (4) The urethra

### **(1) Kidneys**

#### **External Structure**



**Colour** - Dark red

**Shape** - Bean shaped

**Weight** - 125 - 170 gms.

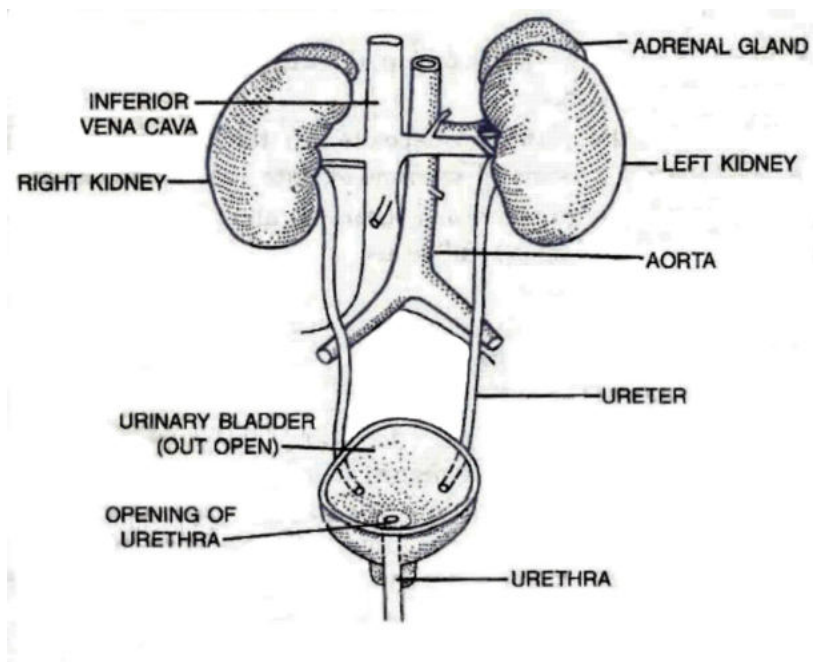
**Size** - 10 cm length, 5 cm breadth, 3 cm thickness.

**Position** - Located laterally either sides of vertebral column.

	<b>ON YOUR TIPS</b>	
The kidneys have a higher blood flow than brain, liver or heart.		

**Kidneys** are the main organs of urinary system. Each kidney is bean shaped, lateral border is convex and its medial border is concave in the middle and convex at each. In the centre of the medial concave border there is present a notch known as the **hilum**, which contains the renal blood vessels and nerves and the **renal pelvis**, which is the funnel-shaped upper end of the ureter.



Urine produced by the kidneys is temporarily stored in the urinary bladder and passed out through urethra.



**Fig-1 The Human Excretory System**

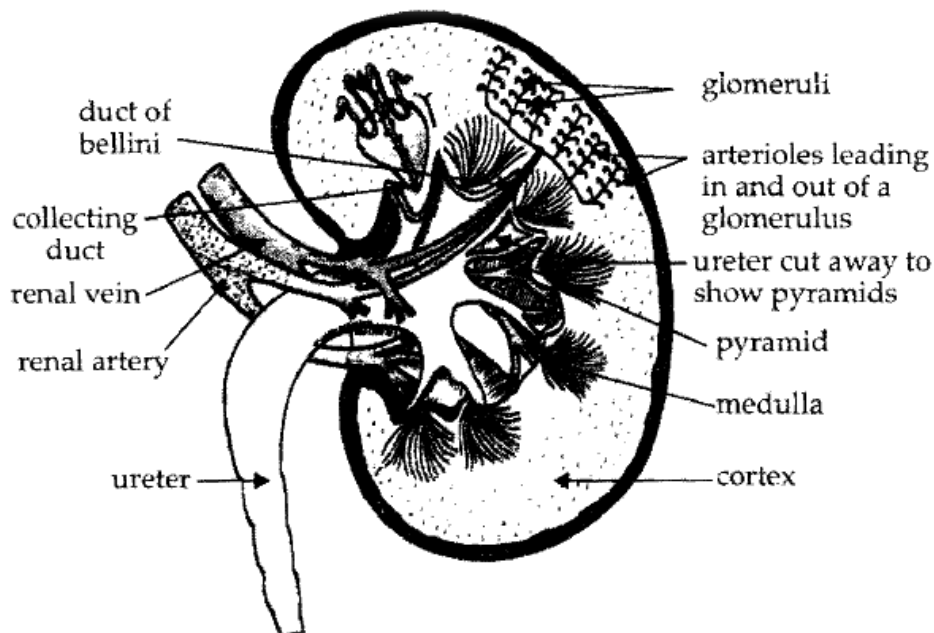
### • Functions of the Kidney

1. It maintains water equilibrium, pH equilibrium, ionic equilibrium of the blood and osmotic equilibrium.
2. It helps to excrete out waste product urea in the dissolved form from the blood.
3. It excretes poisonous substances like drugs, toxins etc., from the body.
4. It regulates blood pressure by controlling the fluid balance in the body.
5. Many ions derived from food are excreted in the urine. They include sodium, potassium, magnesium, calcium, chloride, phosphate, sulphate and oxalate ions. (These movements of ion are important in helping to maintain the acid-base balance of the body and keeping the pH of arterial blood at 7.40.)

	<b>ON YOUR TIPS</b>	
These movement of ion are important in helping to maintain the acid-base balance of the body and keeping the pH of arterial blood at 7.40.		

### Internal Structure

The internal structure of kidneys can be divided into two parts.  
Its outer part is called cortex and inner part is called medulla.



**Fig -2 Internal Structure of kidney**



### NEPHRON

The nephron is the structural and functional unit of the kidney.

Each kidney of man is formed of about one million nephrons. Each nephron has a length of about 3cm. It is differentiated into 4 regions.



- (a) Bowman's capsule
- (b) Proximal convoluted tubules (PCT)
- (c) Loop of henle
- (d) Distal convoluted tubule (DCT)

	<b>ON YOUR TIPS</b>	
Bowman's capsule was named after Sir William Bowman, a British surgeon and anatomist. Malpighian body was named after Marcelo Malpighi, an Italian physician and biologist.		

### (a) Bowman's capsule

It is a large double walled cup. It lies in the renal cortex. It contains a tuft of capillaries called glomerulus and the outer wall is continuous with the rest of the nephron. The space between the two walls of the Bowman's capsule is continuous with the lumen of the next part of the nephron. The Bowman's capsule and the glomerulus together constitutes the renal corpuscle or malpighian body.

### (b) PCT

It starts from the back of the Bowman's capsule and it is highly convoluted. It lies in the renal cortex. The wall consists of a single layer of columnar cells bearing a lot of microvilli on the surface.

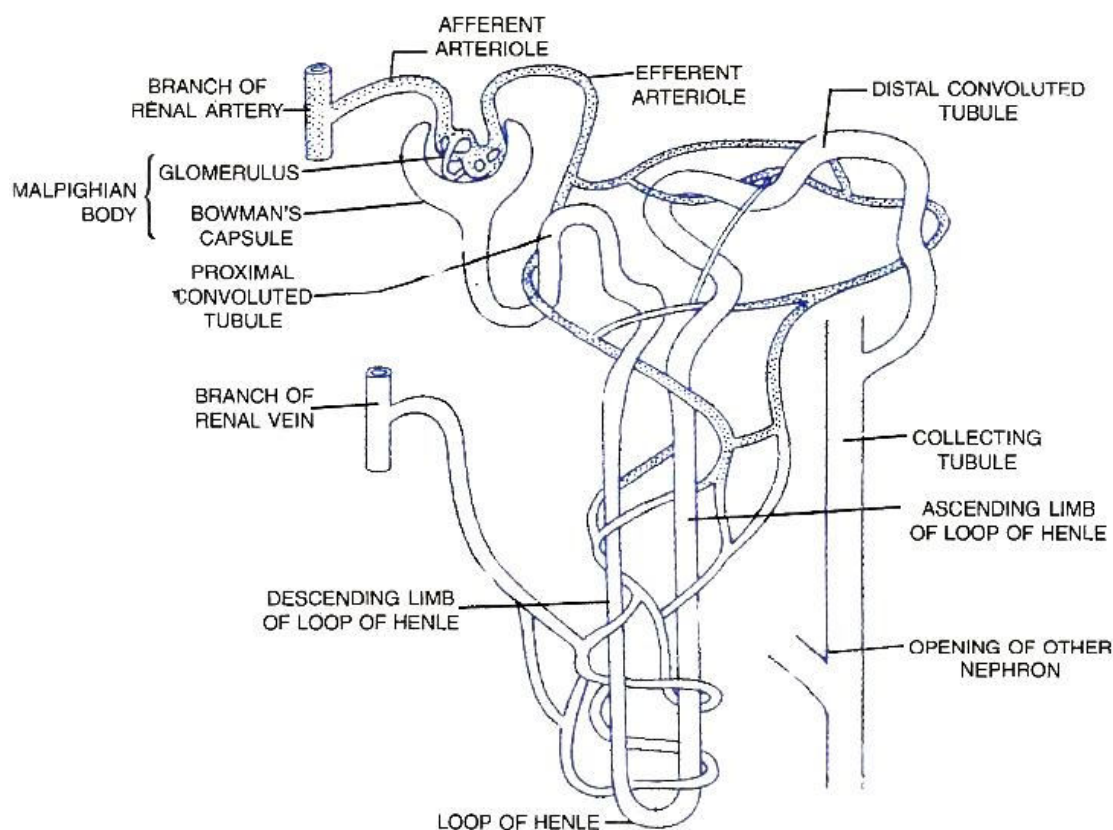
### (c) Loop of Henle

It is a V shaped segment of the nephron located in the renal medulla. It consists of two straight parallel limbs : a descending limb which is a continuation of the PCT and enters into the renal medulla and an ascending limb which re-enters the renal cortex and joins the DCT.

### (d) DCT

It is greatly twisted like the PCT and lies in the renal cortex. The terminal relatively short part of the DCT is called the collecting tubule. It open into the collecting duct.

The collecting ducts receive the collecting tubules of several nephrons.



**Fig - 3 Structure of Nephron**



**A Little further 4.2**

How does kidney help in regulating the pH of our body?

**Explanation**

The kidneys provide a slower but more powerful means of regulate pH. They excrete or absorb hydrogen ions ( $H^+$ ) and bicarbonate ions ( $HCO_3^-$ ) as necessary for adjusting pH.

**(2) Ureter**

They are a pair of whitish narrow distensible muscular tubes of about 30 cm length. Each ureter arises from hilus part of the kidney. It moves downwardly and opens obliquely into urinary bladder. Ureters carry urine from kidneys to the urinary bladder.

**(3) Urinary Bladder**

It is a median pear shaped distensible sac that occurs in the pelvic part of abdomen. It stores urine brought by the two ureters. The storage capacity is 300-800 ml.

**(4) Urethra**

It is a tube that takes urine from urinary bladder to outside. The opening of urinary bladder into 'urethra is guarded by a ring of muscles or sphincter. Urethra is 4 cm long in females and about 20 cm long in males. Its opening is separate in females but is common with reproductive tract in males.

**PRACTICE ZONE**

4.1



1. Name the u-shaped tubule of nephron.
2. What is the main function of kidney?
3. Name the homeostatic orgain of our body.
4. Which part of kidney acts as dialysis bag?

**PHYSIOLOGY OF URINE FORMATION (EXCRETION)**

Main function of nephron is to form urine. There are three main processes involved in the urine formation :

**1. Glomerular ultrafiltration**

- It is the filtration of body fluids and solutes from the blood, out of the glomerular capillaries into the Bowman's capsule due to the pressure in the glomerulus.
- All substances from the blood are filtered out except the large protein molecules. This fluid in the glomerular capsule is called glomerular filtrate.
- It consists of water, urea, salts, glucose and other plasma solutes.
- Blood coming out of the efferent arteriole is therefore thick.

	<b>ON YOUR TIPS</b>	
<p>About 180 litres of glomerular filterate is ormed by both kidneys in a day but urine excreted is, about 1-2 litres a day. This shows that most of glomerular filterate is reabsorbed.</p>		

- About 180 litres of glomerular filterate is ormed by both kidneys in a day but urine excreted is, about 1-2 litres a day. This shows that most of glomerular filterate is reabsorbed.





## 2. Tubular Reabsorption

- Glomerular filtrate contains a lot of useful materials like glucose, salts such as that of sodium and water.
- These substances are reabsorbed from the renal tubule at various levels and in varied proportions.
- Glucose is reabsorbed completely from the proximal convoluted tubules.
- More than 85% of water is reabsorbed from the proximal, distal and even in collecting tubules.
- Sodium chloride is reabsorbed in the proximal and distal tubules.
- Potassium is completely reabsorbed from the proximal tubule.
- Phosphate is reabsorbed in the proximal tubule, etc, Other substances reabsorbed are uric acid, sulphates, vitamin C, amino acids etc.

## 3. Tubular Secretion

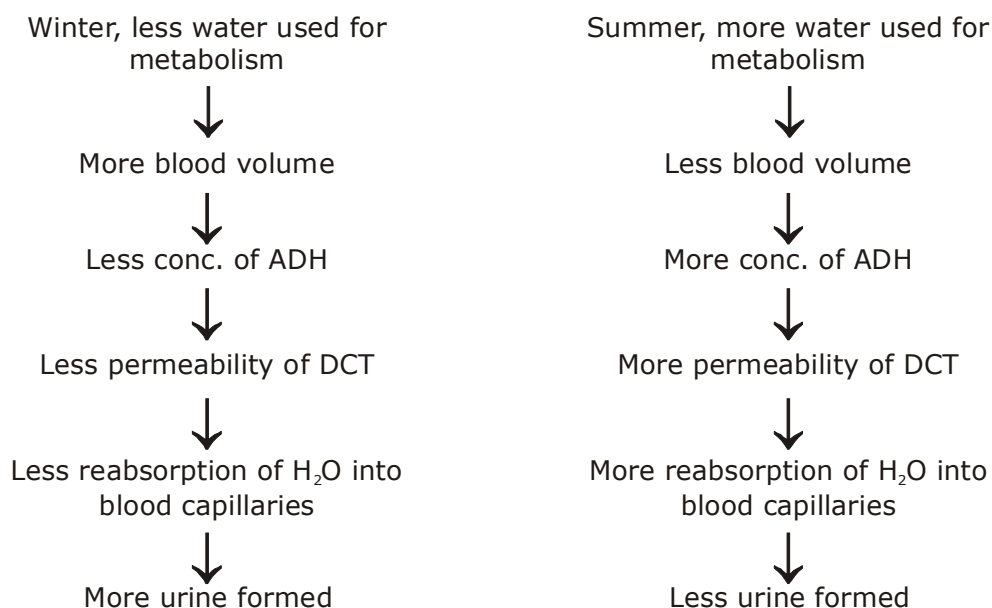
- This occurs mainly in the distal convoluted tubule and the collecting duct of the nephron.
- It is an active, vital process performed by the cells of the cuboidal epithelium lining the tubules which excrete additional wastes from the blood stream into the filtrate by active transport,
- In this process substances like potassium, hydrogen, creatinine and certain drugs like phenol, penicillin etc., are directly excreted by the tubular cells from the blood.
- The fluid which now flows through the last parts of the tubule is urine which consists of water, urea, uric acid, mineral ions like sodium, potassium, chloride, phosphates etc.

## COMPOSITION OF URINE



It is a transparent fluid produced by the excretory system. Normal urine is a yellow fluid and slightly (pH = 6)

Urine contains -

- (i) Water – 96%
- (ii) Organic substance – 25%  
(urea, uric acid, creatine, creatinine, vitamins)
- (iii) Inorganic substances – 1.5%  
(Na, Ca, Phosphate, Sulphate)



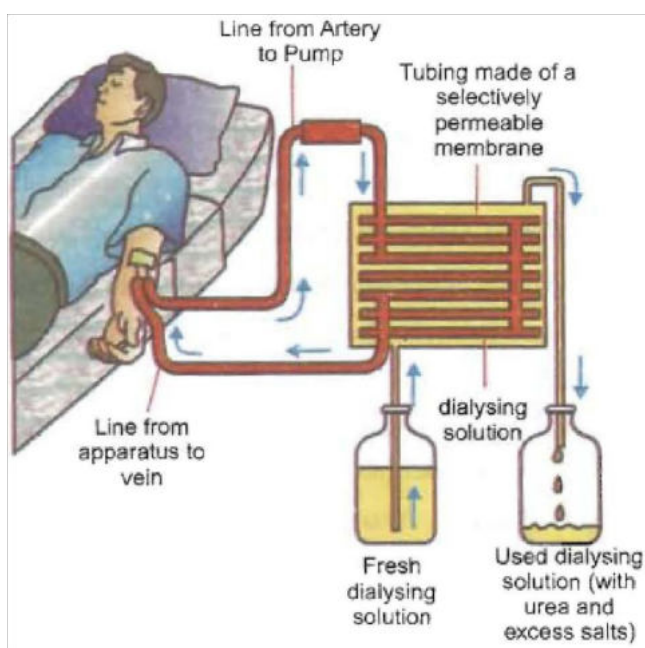
1. Loop of henle.
2. Osmoregulation.
3. Kidney.
4. Kidney tubules.

	<b>ON YOUR TIPS</b>	
Urea, main nitrogen waste in our body, is always formed in liver through ornithine cycle.		

## ARTIFICIAL KIDNEY OR HAEMODIALYSIS



Kidney is a very important organ which is essential for maintaining internal homeostasis as it is engaged in elimination of the nitrogenous and other metabolic by-products. Even if one kidney is damaged, the second kidney can carry on the function of excretion completely. However, if both the kidneys are damaged, a new compatible kidney has to be grafted. Till that period, waste products are removed with the help of haemodialysis (blood dialysis), injury or infection or artificial kidney.

Artificial kidney is a physico-chemical device to remove excretory products from blood in case of temporary disfunction (due to toxins, injury or infection) or near failure of kidneys. It is based on the principle of dialysis or separation of smaller solutes or ions from larger particles with the help of an ultrafilter. The artificial kidney or dialysis machine consists of a number of cellophane tubes embedded in a dialysate or dialysing fluid. The dialysing fluid has the same osmotic concentration as that of blood. However, it contains more of glucose. Nitrogenous waste products, phosphates and sulphates are excluded.



**Fig - 4 Artificial kidney/Haemodialysis**

Blood from an artery, or a vein fitted to a pumping mechanism, is mixed with heparin, cooled at 0° C and passed into cellophane tubes of artificial kidney. Nitrogenous waste products, sulphate and phosphate of blood pass into dialysing fluid. Purified blood is warmed and mixed with antiheparin. It is passed back into vein. The whole process takes 3-4 hours.

	<b>ON YOUR TIPS</b>	
Pale yellow colour of urine is due to the Urochrome pigment. It is formed in the blood due to the reduction of Haemoglobin. So in the body of a healthy animal urochrome is found in a very less amount.		

#### • Uses of Artificial kidney/Haemodialysis

##### 1. **Toxins**

Haemodialysis helps in removing toxins from the body before they are able to damage the body permanently.

##### 2. **Uraemia**

Patients suffering from kidney infections and uraemia (excess of urea in blood) are provided relief for some time.

##### 3. **Renal Failure**

In case of near permanent damage to kidney, haemodialysis provides time to the patient to find a kidney donor.

##### 4. **Normal Life**

In between two dialysis, a patient can lead a near normal life.

##### 5. **Clean Procedure**

Haemodialysis is a clean procedure where chances of infection are minimum.

## EXCRETION IN PLANTS

Plants produce a number of waste products during their life processes.

- The main waste products produced by plants are carbon dioxide, water vapour and oxygen.
- Plants get rid of excess water by transpiration.
- The gaseous wastes of respiration and photosynthesis in plants (carbon dioxide, water vapour and oxygen) are removed through the 'stomata' in leaves and 'lenticels' in stems and released to the air.
- Many plant waste products are stored in cellular vacuoles. Wastes products may be stored in leaves that fall off, other waste products are stored as resins and gums.
- Plants excrete some waste substances into the soil around them.
- Some of the plant wastes which are useful to humans are - Natural rubber, gum, resins and essential oils like sandalwood oil, eucalyptus oil, clove oil and lavender oil.



**N.C.E.R.T TEXT BOOK SOLUTION**

**Q.1** What are the methods used by plants to get rid of excretory products?

**Ans.** Various methods are used by plants to get rid of wastes. Some are-

- (i) Respiratory wastes, i.e.,  $\text{CO}_2$  is expelled through stomata by diffusion.
- (ii) Excess water is excreted by the process of transpiration.
- (iii) Various excretory products may be stored in leaves, bark or fruits of plant which eventually fall off.
- (iv) Several plants expel the waste products in form of resins, gums, tannins and alkaloids.
- (v) In some plants, wastes remain present in the form of crystals of calcium oxalate.

**Q.2** How is the amount of urine produced regulated?

**Ans.** The amount of urine produced is regulated by volume of blood and antidiuretic hormone (ADH) or vasopressin secreted from posterior pituitary gland. This hormone takes part in reabsorption of water from the nephric filtrate. If sufficient water is present in blood, little amount of ADH is secreted and more nephric filtrate or urine is formed. If less amount of water is present in blood, then more ADH will be secreted and more water will be reabsorbed from nephric filtrate and hence less urine will be produced.

**Q.3** Describe the structure and functioning of nephrons.

**Ans.** See text



**EXERCISE – I****NTSE /OLYMPIAD /FOUNDATION PROBLEMS**

- Q.1** Waste product/s produced by plants is/are  
(A) CO<sub>2</sub> (B) Water (C) Oxygen (D) All of these
- Q.2** Waste product produced during respiration in plant :  
(A) CO<sub>2</sub> (B) Water (C) Oxygen (D) A and B
- Q.3** In photosynthesis the waste product is :  
(A) CO<sub>2</sub> (B) Oxygen (C) Nitrogen (D) None of these
- Q.4** The gaseous wastes of respiration and photosynthesis in plants are removed through:  
(A) Stomata of leaves (B) Lenticels of stem  
(C) Stomata and lenticels (D) None of these
- Q.5** Which of the following statement(s) is / are correct :  
(A) Gums are found in babool tree  
(B) Leaves of tulsi contain essential oils  
(C) Leaves of amla and tea contain tannins  
(D) All of the above
- Q.6** Plant gets rid of excess water by  
(A) Photosynthesis (B) Respiration  
(C) Transpiration (D) None of these
- Q.7** Kidney of vertebrates resembles with contractile vacuole of protozoans in  
(A) expelling out glucose  
(B) expelling out urea and uric acid  
(C) expelling out excess of water  
(D) expelling out salts
- Q.8** Ureotelic animals are those which eliminate the nitrogenous wastes predominantly in the form of  
(A) uric acid (B) ammonia (C) amino acids (D) urea
- Q.9** The vessel which leads blood into the Bowman's capsule is :  
(A) afferent arteriole (B) efferent arteriole (C) renal vein (D) renal artery
- Q.10** The conversion of protein waste, the ammonia into urea occurs mainly in :  
(A) kidney (B) lungs (C) liver (D) intestine

**Fill in the blanks**

- The process of removal of metabolic wastes from the body is known as .....
- ..... is the largest gland of the human body.
- ..... is the outer dark part of the kidney.
- In the glomerulus blood comes from the ..... arteriole.
- ..... hormone helps in osmoregulation.
- ..... artery brings blood to the kidneys.
- ..... is the functional unit of kidneys.

**ANSWER KEY**

1. (D) 2. (D) 3. (B) 4. (C) 5. (D) 6. (C) 7. (C)  
8. (D) 9. (A) 10. (C)

**Fill in the blanks**

- |              |                 |           |
|--------------|-----------------|-----------|
| 1. Excretion | 2. Liver        | 3. Cortex |
| 4. Afferent  | 5. Antidiuretic | 6. Renal  |
| 7. Nephrons  |                 |           |



**EXERCISE – II****PRACTISE FOR SUMMATIVE ASSESSMENT****Very short Answer Question :**

- Q.1** Name various waste products which need to be removed from the body.
- Q.2** What is malpighian body?
- Q.3** List various organs of urinary system.
- Q.4** What creates pressure in the glomerulus?
- Q.5** Which endocrine gland secretes antidiuretic hormones ?
- Q.6** Write the full form of ADH.
- Q.7** Why proteins are not filtered in glomerulus ?
- Q.8** If you donate one kidney, would it cause any harm the excretory unit of kidneys.
- Q.9** Name the excretory unit of kidneys.
- Q.10** Where is urine carried through ureters ?

**Short answer Questions :**

- Q.1** Why is excretion necessary ? Name the common excretory substance in our body.
- Q.2** In what forms are nitrogenous wastes excreted in birds. humans and fishes respectively? Why do they do so differently ?
- Q.3** How does liver help in excretion ?
- Q.4** Draw well labelled diagram showing structure of nephron.
- Q.5** Explain the process of reabsorption in the nephron during the urine formation in humans.

**Long Answer Questions :**

- Q.1** Explain the structure of nephron.
- Q.2** (a) Draw a diagram of the human urinary system and label in it :  
 (i) Kidney  
 (ii) Ureter  
 (iii) Urinary bladder  
 (iv) Urethra  
 (b) Name the two major components of normal human urine.



# EXERCISE-I

- Artificial removal of metabolic wastes from the body is called as –  
(A) Ultra filtration (B) Dialysis (C) Osmoregulation (D) None of these
- Human kidney resembles contractile vacuole of Amoeba in expelling out –  
(A) Excess  $H_2O$  (B) Salts (C) Glucose (D) Urea
- The units of a mammalian kidney are –  
(A) Nephrons (B) Seminiferous tubules (C) Uriniferous tubules (D) Ureters
- $NH_3$  converted to urea in –  
(A) Kidney (B) Liver (C) Spleen (D) Heart
- Glomerular filtrate normally contain –  
(A) Glucose (B) NaCl (C) Amino acids (D) All of these
- Man is –  
(A) Uricotelic (B) Ureotelic (C) Ammonotelic (D) None of these
- Which is not excretory organ?  
(A) Skin (B) Kidney (C) Liver (D) Pancreas
- Special excretory organ is lacking in :  
(A) Earthworm (B) Amoeba (C) Man (D) Insects
- Which of the following is not a excretory product in plant –  
(A) Terpentine oil (B) Latex  
(C) Glucose produced during photosynthesis (D) Oxygen
- Sweat is an excretory waste because it contains  
(A)  $N_2$  waste (B) excess  $H_2O$  (C) Salts (D) All of the above
- Urea cycle occur in  
(A) Nephron (B) Spleen (C) Pancreas (D) Liver
- Henle's loop is short or absent in  
(A) Fresh water fish (B) Birds (C) Mammals (D) All of the above
- The white matter in a bird's dropping is  
(A)  $CaCO_3$  (B)  $CaSO_4$  (C) Uric acid (D) Urea
- Identify the uricotelic animal  
(A) Pisces (B) Amphibia (C) Man (D) Aves
- Organic acids which may be poisonous to a plant are stored in –  
(a) Vacuoles (B) Palisade cell (C) Mesophyll (D) Xylem vassels
- The urinary bladder of a man empties outside by means of  
(A) Ureter (B) Urethra (C) Vagina (D) Glands
- Which of the following needs large amount of water for excretion?  
(A) Urea (B) Ammonia (C) Uric acid (D) Amino acids

# EXERCISE-II

## SECTION-A

### • Fill in the blanks

- Glucose is broken down to provide energy in the form of \_\_\_\_\_.
- The circulatory system consist of the \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_.





## LIFE PROCESSES

3. Plant store waste in the form of \_\_\_\_\_ and \_\_\_\_\_.
4. \_\_\_\_\_ help in ultrafiltration in kidney.
- **Multiple blanks**
5. Double circulatory system of blood flow includes two distinct and separate systems. This distinction is shared by most vertebrates including amphibians, \_\_\_\_\_ and mammals. In contrast, fish have a single circulation system because they lack \_\_\_\_\_.  
(A) Birds, Lungs (B) Reptiles, lungs (C) Arthropoda, Lungs (D) Birds, Gills

## SECTION-B

- **Multiple choice question with one correct answers**
1. Which among them is not correct equation of an anabolic process in plants  
(A)  $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$  (B)  $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$   
(C)  $6CO_2 + 12H_2O \rightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$  (D) All of these
  2. Organelle responsible for anabolic process of food production in plant.  
(A) Mitochondria (B) Peroxisome (C) Ribosome (D) Plastids
  3. A major metabolic process taking place in germinating seed to  
(A) Photosynthesis (B) Absorption of water  
(C) Absorption of mineral (D) Respiration
  4. Catabolism is  
(A) Anabolism first than metabolism (B) Breakdown of the product of anabolism  
(C) Formation of the product in a cell (D) All of the above
  5. Growth in a plant is because of  
(A) More anabolism than catabolism (B) More catabolism than anabolism  
(C) Equal amount of anabolism and catabolism (D) More energy consumption
  6. Photosynthetically active radiation (PAR) represents the following range of wavelength  
(A) 400 – 700 nm (B) 500 – 600 nm (C) 450 – 950 nm (D) 340–450 nm
  7. In chlorophyll which metal is present?  
(A) Mn (B) Mo (C) Mg (D) S
  8. Photolysis of water take place in  
(A) Absorption (B) Transpiration (C) Respiration (D) Photosynthesis
  9. Photolysis is  
(A) Another name for photosynthesis (B) Another name for respiration  
(C) Breakdown of glucose (D) Breakdown of water
  10. During light reactions the following molecules are formation  
(A) ATP (B) ATP & NADPH (C) NADPH (D) None
  11. Dark reaction of photosynthesis  
(A) Takes place in dim light  
(B) Takes place both in light and dark  
(C) Is termed as dark reaction because it is inhibited by light  
(D) Utilizes the assimilatory power formed in light reaction
  12. In which form is food transported in plants  
(A) Sucrose (B) Fructose (C) Glucose (D) Lactose
  13. Some plant absorb  $CO_2$  at night. They are  
(A) Water plant (B) Land plant (C) Desert plant (D) Both (A)&(B)
  14. Magnesium is constituent of which pigment?  
(A) Florigen (B) Chlorophyll (C) Haemoglobin (D) Enzyme
  15. In photosynthesis  
(A)  $CO_2$  is reduced while  $H_2O$  oxidized (B)  $CO_2$  is oxidized while  $H_2O$  reduced



## LIFE PROCESSES

- (C)  $\text{CO}_2$  and  $\text{H}_2\text{O}$  are oxidized (D)  $\text{CO}_2$  &  $\text{H}_2\text{O}$  are reduced
16. In chloroplast, chlorophyll is present in the  
(A) Stroma (B) Outer membrane (C) Inner membrane (D) Thylakoids
17. Phenomenon which converts light energy into chemical energy is  
(A) Respiration (B) Photosynthesis (C) Transpiration (D) None of these
18. Chlorophyll in chloroplast is located in  
(A) Grana (B) Pyrenoid (C) Stroma (D) None of these
19. Photosynthesis is maximum in which light  
(A) Red light (B) Green light (C) Low light intensity (D) High light intensity
20. Cell organelle associated with conversion of light energy to chemical energy.  
(A) Chloroplast (B) Mitochondria (C) Ribosome (D) ER
21. Stomata of desert plant/succulent plant are  
(A) always open  
(B) open during the day and close during the night  
(C) Open during the night and close during the day (D) Never open

## SECTION-C

### • Multiple choice question with one or more than one correct answers

1. Which of them is a part of stomata  
(A) Guard cell (B) Chloroplast (C) Stomatal pore (D) Germ pore
2. These are found in leaves  
(A) Waxy cuticle (B) Palisade (C) Spongy Parenchyma (D) Midrib
3. Enzyme produced by pancreas.  
(A) Cellulase (B) Polymerase (C) Amylase (D) Lipase
4. Pseudopodia helps in  
(A) Respiration (B) Movement (C) Capturing Food (D) Egestion
5. End product of aerobic respiration  
(A)  $\text{CO}_2$  (B)  $\text{H}_2\text{O}$  (C) Lactic acid (D) Ethanol

## SECTION-D

### • Assertion & Reason

Instructions: In the following questions as Assertion (A) is given followed by a Reason (R). Mark your responses from the following options.

- (A) Both Assertion and Reason are true and Reason is the correct explanation of 'Assertion'  
(B) Both Assertion and Reason are true and Reason is not the correct explanation of 'Assertion'  
(C) Assertion is true but Reason is false  
(D) Assertion is false but Reason is true

1. **Assertion:** Oxygen is absorbed by different organs in different organism.  
**Reason:** All these organs have structure that increase surface area
2. **Assertion:** It would take 3 year for a molecule of oxygen to get to our toes from our lungs.  
**Reason:** Diffusion is movement from high to low concentration

## SECTION-E

### • Match the following (one to one)

**Column-I** and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. Only One entries of column-I may have the matching with the some entries of column-II and one entry of column-II Only one matching with entries of column-I



**1. Column I**

- (A) Bronchiole
- (B) Vena cava
- (C) Glomerulus
- (D) Villi

**Column II**

- (P) Circulation
- (Q) Absorption
- (R) Respiration
- (S) Excretion

**SECTION-F**

• **Comprehension**

Photosynthesis is a process by which green plant make there own food in the presence of sunlight, water, CO<sub>2</sub> and chlorophyll. If we keep a water plant in a beaker, inverted by a funnel and a test tube placed over having water than we can see bubble of gas accumulated at the bottom of the test tube. This gas down ward displaces water.

1. Name the process by which this gas is produced  
(A) Respiration (B) Transpiration (C) Photolysis (D) None
2. Which among them is not an aquatic plant?  
(A) Hydrilla (B) Hydra (C) Vallisneria (D) Lotus
3. Gas that helps in formation of ozone comes out during.  
(A) Respiration (B) Photosynthesis (C) Absorption (D) Translocation

**SECTION-G**

• **Match the following (one to many)**

**Column-I** and **column-II** contains **four** entries each. Entries of column-I are to be matched with some entries of column-II. One or more than one entries of column-I may have the matching with the some entries of column-II and one entry of column-II may have one or more than one matching with entries of column-I

**1. Column I**

- (A) Lactic acid
- (B) Ethanol
- (C) CO<sub>2</sub>
- (D) O<sub>2</sub>

**Column II**

- (P) Aerobic respiration
- (Q) Anaerobic respiration
- (R) Photosynthesis
- (S) Transpiration

**EXERCISE-III(OLYMPAID)**

1. Contraction of right ventricle pumps blood into :-  
(A) right auricle (B) pulmonary artery (C) pulmonary vein (D) dorsal aorta
2. Urine leaves the kidney through :-  
(A) Urethra (B) collecting duct (C) renal vein (D) ureter
3. The capillaries join to form :-  
(A) arterioles (B) arteries (C) veins (D) venules
4. Nitrogenous wastes are formed from the breakdown of :-  
(A) ammonia (B) fat (C) amino acids (D) water
5. Which of the following colours of light in the visible spectrum is the most effective in photosynthesis ?  
(A) Red (B) Green (C) Violet (D) Yellow
6. In respiration, air passes through :-  
(A) Pharynx, nasal cavity, larynx, trachea, bronchi, bronchiole, lungs  
(B) Nasal cavity, pharynx, larynx, trachea, bronchi, bronchioles, Alveoli  
(C) Larynx, nasal cavity, pharynx, trachea, lungs



- (D) Larynx, pharynx, trachea, lungs
7. The exchange of gases in the alveoli of the lungs takes place by :-  
 (A) Osmosis (B) simple diffusion (C) Passive transport (D) Active transport
  8. The exchange of gases ( $O_2$  and  $CO_2$ ) in a mammal takes place in :-  
 (A) Trachea (B) Bronchi (C) Bronchioles (D) Alveoli
  9. The matrix of chloroplast is known as :-  
 (A) Grana (B) Stroma (C) Thylakoid (D) Lamellae
  10. The word 'Sapro' means :-  
 (A) Cell sap (B) Dead (C) Other (D) Rotten
  11. Compensation point occurs :-  
 (A) When intensity of light is high (B) During dark  
 (C) During morning and evening hours (D) During mid-day
  12. During light reaction, the photosynthetic pigments absorb light energy in the form of :-  
 (A) Electrons (B) Protons (C) Neutrons (D) Photons
  13. The chlorophylls absorb mostly :-  
 (A) Blue and green light (B) Blue and red light (C) Green and red light (D) Green light
  14. The excretory organs of grasshopper are called :-  
 (A) Malpighian tubules (B) Hepatic caeca (C) Crop (D) Gizzard
  15. Exchange of gases involves :-  
 (A) Osmosis (B) Diffusion (C) Imbibition (D) Suction pressure
  16. Breathing out of carbon dioxide is called :-  
 (A) Inhalation (B) Reduction (C) Exhalation (D) Degeneration
  17. Trachea are the respiratory organs of :-  
 (A) Fish (B) Cockroach (C) Earthworm (D) Frog
  18. Nutrients are translocated in plants through :-  
 (A) Xylem tracheids (B) Phloem sieve tubes  
 (C) Xylem vessels (D) Phloem companion cells
  19. Which of the following statements is not correct :-  
 (A) Tracheids and vessels are non-living conducting tissues  
 (B) Deoxygenated blood is poured into right atrium of heart  
 (C) The excretory units of flatworms are flame cells  
 (D) Human kidney has about 1 million nephridia
  20. The blood cells responsible for clotting of blood are :-  
 (A) Erythrocytes (B) Blood platelets  
 (C) White blood corpuscles (D) Red blood cells
  21. The procedure used in artificial kidney in place of normal is called :-  
 (A) Pace maker (B) Electrocardiograph (C) Osmoregulation (D) Dialysis
  22. Human heart is :-  
 (A) Three chambered (B) Four chambered  
 (C) Excretory organ (D) Osmoregulatory organ
  23. Blood from superior vena cava flows into :-  
 (A) Right atrium (B) Right ventricle (C) Left atrium (D) Left ventricle
  24. As blood flows out of a damaged blood vessel, blood platelets release a substance called :-  
 (A) Thrombin (B) Prothrombin (C) Thromboplastin (D) Fibrin
  25. The cup shaped upper end of nephron is called :-  
 (A) Bowman's capsule (B) Glomerulus (C) Nephrostome (D) Nephridiopore
  26. Which one of following enzymes is present in saliva ?  
 (A) Pepsin (B) Ptyalin (C) Trypsin (D) Chymotrypsin
  27. Goitre is caused due to deficiency of :-  
 (A) Calcium (B) Iodine (C) Fluorine (D) Phosphorus



28. Deficiency of protein in a child, in the age group of 1 to 3 years, causes :-  
 (A) Marasmus (B) Dwarfism (C) Gigantism (D) Kwashiorkor
29. Trypsinogen is converted to active trypsin by :-  
 (A) Enterocrinin (B) Secretin (C) Enterokinase (D) Pancreozymin
30. Release of pancreatic juice is stimulated by :-  
 (A) Enterokinase (B) Cholecystokinin (C) Gastrin (D) Secretin
31. Bilirubin and biliverdin are :-  
 (A) Bile salts (B) Bile pigments (C) Enzymes (D) None of these
32. Secretin hormone is secreted by :-  
 (A) Liver (B) Pancreas (C) Ileum (D) Duodenum
33. Ptyalin is secreted by :-  
 (A) Salivary glands (B) Brunner's glands (C) Gastric glands (D) Digestive glands
34. If we take food rich in lime juice, then :-  
 (A) Action of ptyalin on starch is enhanced (B) Action of ptyalin on starch is reduced  
 (C) Action of ptyalin on starch is unaffected (D) Action of ptyalin on starch stops
35. Xerophthalmia is caused by the deficiency of vitamin :-  
 (A) E (B) D (C) B (D) A
36. Water is mainly absorbed in :-  
 (A) Colon (B) Stomach  
 (C) Oesophagus (D) Small intestine
37. Chylomicrons are :-  
 (A) Undigested proteins (B) Undigested carbohydrates  
 (C) Fat droplets coated with phospholipids (D) Fat droplets coated with glycoproteins
38. Beri-Beri is caused by deficiency of vitamin :-  
 (A) B<sub>1</sub> (B) B<sub>2</sub> (C) C (D) E
39. Pepsin is secreted by :-  
 (A) Zymogen cells (B) Epithelial cells (C) Pancreas (D) Liver
40. Vitamin K is useful for :-  
 (A) Converting prothrombin to thrombin (B) Synthesis of prothrombin  
 (C) Calcium combination with prothrombin (D) All of these
41. Maximum food absorption takes place in :-  
 (A) Ileum (B) Colon (C) Rectum (D) Stomach
42. In gluconeogenesis :-  
 (A) Glucose is polymerized into glycogen  
 (B) Glycogen is broken into glucose  
 (C) Molecules of glucose are synthesized from fats and proteins  
 (D) Glucose is broken into pyruvic acid
43. Which part of digestive system secretes peritrophic membrane around food in cockroach ?  
 (A) Crop (B) Gizzard (C) Hepatic caeca (D) mesenteron
44. The largest quantity of air that can be expired after a maximal inspiratory effort is :-  
 (A) Residual volume (B) Tidal volume (C) Vital capacity of lungs (D) Lung volume
45. Which is main form in which CO<sub>2</sub> is transported by blood ?  
 (A) Carbonic acid (B) Oxyhaemoglobin (C) Carboxyhaemoglobin (D) Bicarbonates
46. A 2-layered sac surrounding the lung is :-  
 (A) Pericardium (B) Pleura (C) Perichondrium (D) Periosteum
47. How many molecules of O<sub>2</sub> can associate with a molecule of haemoglobin in man ?  
 (A) One (B) Two (C) Three (D) Four
48. Book lungs are respiratory organs of :-  
 (A) Scorpion (B) Crustaceans (C) Insects (D) Centipedes



## LIFE PROCESSES

- 49.** Structure which prevents the entry of food in the wind pipe is :-  
 (A) Pharynx (B) Glottis (C) Gullet (D) Epiglottis
- 50.** During hibernation, frog respire by :-  
 (A) Only skin (B) Only lungs  
 (C) Only buccopharyngeal cavity (D) Partly skin and partly lungs
- 51.** Painful breathing is called :-  
 (A) Eupnoea (B) Hypopnoea (C) Apnoea (D) Dyspnoea
- 52.** Principal inspiratory muscle is :-  
 (A) External intercostal (B) Internal intercostal (C) Abdominal (D) Phrenic
- 53.** Entire haemoglobin of blood becomes oxidised while it goes out of lung and it releases oxygen in body tissues, because :-  
 (A) Of reduction of oxyhaemoglobin  
 (B) In comparison to lung, tissues have high conc. of  $\text{CO}_2$   
 (C) Tissues can absorb oxygen from haemoglobin  
 (D) Tissues have high conc. of  $\text{O}_2$  and low conc. of  $\text{CO}_2$
- 54.** The respiratory centres, which control inspiration and expiration, are located in :-  
 (A) Cerebellum (B) Diencephalon (C) Medulla oblongata (D) Spinal cord
- 55.** Site of respiration in bacteria is :-  
 (A) Episome (B) Mesosome (C) Ribosome (D) Microsome
- 56.** How the transport of  $\text{O}_2$  and  $\text{CO}_2$  by blood occurs :-  
 (A) With the help of RBCs and blood plasma (B) With the help of RBCs and WBCs  
 (C) With the help of WBCs and blood serum (D) With the help of platelets and corpuscles
- 57.** Air bladder or swim bladder in fishes is associated with :-  
 (A) hydrostasis (B) gaseous exchange  
 (C) sound production (D) All of the above
- 58.** Haemoglobin is having maximum affinity with :-  
 (A)  $\text{NH}_3$  (B)  $\text{O}_2$  (C) CO (D)  $\text{CO}_2$
- 59.** In which form,  $\text{CO}_2$  is carried by blood :-  
 (A) Sodium bicarbonate (B) Sodium carbonate  
 (C) Potassium carbonate (D) Magnesium carbonate
- 60.** Amount of oxygen which is transported by one gram of haemoglobin is :-  
 (A) 20 ml (B) 13.4 ml (C) 1.34 ml (D) None of these
- 61.** Match the structures listed under column-I with the functional names given under column-II. Choose the correct answer which gives correct combination of the alphabets of the two columns :-

	Column-I (Structure)		Column-II (Functional names)
A	Larynx	p	Lid of larynx
B	Trachea	q	Air sacs
C	Alveoli	r	Voice box
D	Epiglottis	s	Wind pipe
		t	Common passage

- (A) A = r, B = t, C = q, D = s  
 (B) A = r, B = s, C = p, D = q  
 (C) A = r, B = s, C = q, D = t  
 (D) A = r, B = s, C = q, D = p
- 62.** A person breathing normally at rest takes in and expels approximately half a litre of air during each respiratory cycle. It is called :-  
 (A) Expiratory reserve volume (B) Tidal volume  
 (C) Inspiratory reserve volume (D) Vital capacity
- 63.** Animals having two respiratory pigments :-





- (A) *Serpula* (B) *Glycera* (C) *Nereis* (D) All of above
- 64.** Dyspnoea is the :-  
 (A) Normal breathing (B) Difficult breathing  
 (C) Rapid breathing (D) Stage without breathing
- 65.** One common feature of trachea of rabbit and trachea of cockroach is that :-  
 (A) Both are paired and branched (B) Both have ciliated epithelium  
 (C) Both originate in pharynx in head region (D) Both have non-collapsible walls
- 66.** Which of the following statement correctly defines Bohr's effect :-  
 (A) Rise of  $P_{50}$  with a decrease in  $CO_2$  conc. (B) Rise in  $P_{50}$  with a decrease in pH  
 (C) Rise of  $P_{50}$  with a decrease in pH (D) Fall in  $P_{50}$  with a decrease in pH
- 67.** The most stable product formed with haemoglobin is by :-  
 (A)  $CO_2$  (B)  $O_2$  (C) CO (D)  $SO_2$
- 68.** Mountain sickness result due to :-  
 (A) Anaemic hypoxia (B) Arterial hypoxia  
 (C) Lack of sufficient Hb (D) Lack of sufficient RBCs
- 69.** Pacemaker of the heart is :-  
 (A) Bundle of His (B) Purkinje fibres (C) A.V. Node (D) S.A. Node
- 70.** Heart with single circulation is found in :-  
 (A) Mammals and birds (B) Reptiles  
 (C) Fishes and amphibians (D) Fishes only
- 71.** The blood pressure is measured by :-  
 (A) Electrocardiogram (ECG) (B) Stethoscope  
 (C) Sphygmomanometer (D) Pulse rate
- 72.** Chemical basis of action of nerve on heart beat was discovered by :-  
 (A) Otto Loewi (B) Pavlov (C) Harvey (D) Landsteiner
- 73.** Second heart sound is :-  
 (A) 'Lub' at the end of systole (B) 'Lub' at the beginning of systole  
 (C) 'Dub' at the end of diastole (D) 'Dub' at the beginning of diastole
- 74.** Blood is red in :-  
 (A) Cockroach (B) Housefly (C) Mosquito (D) None of these
- 75.** The blood vessel of frog which opens in its right auricle bringing oxygenated blood is :-  
 (A) Pulmocutaneous artery (B) Inferior vena cava (C) Pulmocutaneous vein  
 (D) Superior vena cava
- 76.** The largest size of heart is found in :-  
 (A) Elephant (B) Giraffe (C) Crocodile (D) Lion
- 77.** Erythrocytes of adult rabbit and other mammals are formed in :-  
 (A) Kidney (B) Liver (C) Spleen (D) Bone marrow
- 78.** The blood vascular system of mammals is known as double vascular system because :-  
 (A) A group of veins carry oxygenated blood and other group conducts deoxygenated blood  
 (B) Oxygenated blood runs from heart to different organs by one set of veins, while deoxygenated blood runs from heart to lungs by another set  
 (C) Two different blood runs never meet  
 (D) All of these
- 79.** Conversion of fibrinogen to fibrin is catalysed by :-  
 (A) Thrombin (B) Prothrombin (C) Thromboplastin (D) All of these
- 80.** Renal portal system is absent in :-  
 (A) Birds (B) Reptiles (C) Amphibians (D) Reptiles and amphibians
- 81.** Which of the following is helpful for erythropoiesis :-  
 (A)  $Fe^{++}$  (B)  $Mg^{++}$  (C)  $Ca^{++}$  (D)  $Cu^{++}$





**82.** Heart beat originates from :-

- (A) Left atrium (B) Right ventricle (C) Pacemaker (D) Cardiac muscles

**83.** Match the names of the parts listed under column-I with the names of the organs listed under column-II. Choose the answer which gives the correct combination of the alphabets :-

	Column-I (Parts)		Column-II (Organs)
a	Bicuspid valve	p	Brain
b	Nephron	q	Liver
c	Alveoli	r	Heart
d	Cerebrum	s	Kidney
		t	Lungs

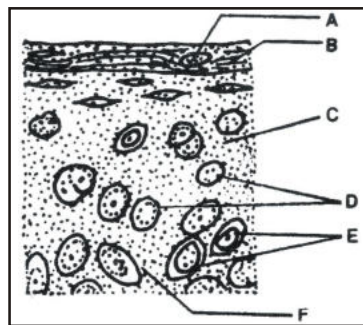
(A) a = r, b = t, c = s, d = p

(B) a = r, b = s, c = t, d = p

(C) a = s, b = q, c = p, d = t

(D) a = s, b = r, c = p, d = t

**84.** In the diagram of the section of hyaline cartilage given below, certain parts have been indicated by alphabets, choose the answer in which these alphabets have been correctly matched with the pairs which they indicate :-



(A) A = Blood vessel, B = Capsular matrix, C = Perichondrium, D = Lacunae, E = Chondrin, F = Chondrocytes

(B) A = Blood vessel, B = Perichondrium, C = Chondrin, D = Lacunae, E = Chondrocytes, F = Capsular matrix

(C) A = Blood vessel, B = Perichondrium, C = Lacunae, D = Chondrin, E = Capsular matrix, F = Chondrocytes

(D) A = Chondrin, B = Capsular matrix, C = Blood vessel, D = Perichondrium, E = Lacunae, F = Chondrocytes

**85.** Match the different leucocytes given under Column I with their functions given under Column II. Choose the answer that gives the correct combination of alphabets of two columns :-

	Column-I (Leucocytes)		Column-II (Functions)
A	Eosinophil	p	Phagocytosis
B	Neutrophil	q	Produce antibodies
C	Lymphocytes	r	Role in allergic response
D	Monocytes	s	Prevents clotting
		t	Differentiate into macrophage

(A) A = t, B = p, C = q, D = f

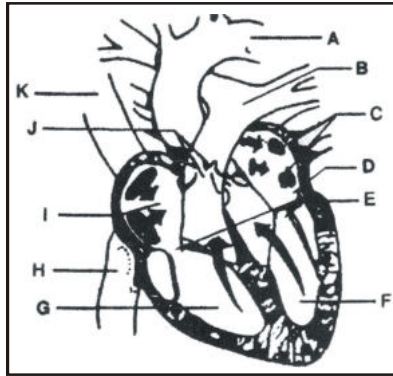
(B) A = r, B = p, C = q, D = t

(C) A = q, B = r, C = s, D = t

(D) A = p, B = q, C = r, D = s

**86.** In the diagram of the vertical section of human heart given below certain parts have been indicated by alphabets. Choose the answer in which these alphabets have been correctly matched with the parts they indicate :-





(A) A = Aorta, B = Pulmonary vein, C = Pulmonary arteries, D = Left ventricle, E = Semilunar valves, F = Left auricle, G = Right auricle, H = Superior vena cava, I = Right ventricle, J = Tricuspid valves, K = Inferior vena cava

(B) A = Aorta, B = Pulmonary artery, C = Pulmonary veins, D = Left auricle, E = Tricuspid and Mitral valves, F = Left ventricle, G = Right ventricle, H = Inferior vena cava, I = Right auricle, J = Semilunar valves, K = Superior vena cava

(C) A = Aorta, B = Superior vena cava, C = Inferior vena cava, D = Right ventricle, E = Tricuspid and Mitral valves, F = Right auricle, G = Left auricle, H = Pulmonary vein, I = Left ventricle, J = Semilunar valves, K = Pulmonary artery

(D) A = Aorta, B = Superior vena cava, C = Inferior vena cava, D = Left ventricle, E = Semilunar valves, F = Left auricle, G = Right auricle, H = Pulmonary artery, I = Right ventricle, J = Tricuspid valves, K = Pulmonary vein

**87.** Carbonic anhydrase is found in :-

- |                  |                     |
|------------------|---------------------|
| (A) WBC          | (B) RBC             |
| (C) Blood plasma | (D) Blood platelets |

**88.** The opening of auricle into ventricle on the right side is guarded by :-

- |                     |                      |
|---------------------|----------------------|
| (A) Tricuspid valve | (B) Semilunar valves |
| (C) Bicuspid valve  | (D) Eustachius valve |

**89.** RBCs are generally destroyed in the liver, while WBCs are destroyed in :-

- |                                  |                              |
|----------------------------------|------------------------------|
| (A) Plasma                       | (B) Lymph                    |
| (C) Inside various cells of body | (D) Outside the blood stream |

**90.** Cardiac cycle in man takes about :-

- |                 |                 |
|-----------------|-----------------|
| (A) 0.5 seconds | (B) 1.0 seconds |
| (C) 1.2 seconds | (D) 0.8 seconds |

**91.** Where are red blood cells formed ?

- |                                   |             |
|-----------------------------------|-------------|
| (A) Spleen                        | (B) Liver   |
| (C) Red bone marrow of long bones | (D) Thyroid |

**92.** The heart pumps only deoxygenated blood :-

- |           |          |           |               |
|-----------|----------|-----------|---------------|
| (A) shark | (B) frog | (C) whale | (D) crocodile |
|-----------|----------|-----------|---------------|



- 93.** A sudden increase in the number of white blood cells in the blood is a sign of :-  
(A) deficiency disease (B) better health (C) bacterial disease, infection (D) mental tension
- 94.** On a slide a drop of anti B serum is placed and then a drop of blood of unknown type is added to it. The blood cells do not clump. The blood type is :-  
(A) A or O (B) B or AB (C) AB or A (D) O or B
- 95.** Which of the following characteristics are of the leucocytes (white blood cells) :-  
(A) They are nucleated and can move from place to place by amoeboid movements  
(B) They (granulocytes) kill bacteria  
(C) They (lymphocytes) produce antibodies  
(D) All of the above
- 96.** Lymph is pushed along its path in lymph vessels :-  
(A) by pumps present in lymph nodes  
(B) by valves present in lymph vessels  
(C) by the contraction of voluntary muscles present on either side of lymphvessels  
(D) by the involuntary muscles present along with lymph vessels
- 97.** In a 70 kg man, kidneys, liver, heart and brain weigh 3.5 kg and skin, muscles and remaining organs weight 66.5 kg. Out of the total cardiac output of 5.6 litres per minute, the first four organs, namely kidneys, liver, heart and brain, receive 3.6 litres while the remaining organs of the body receive 2.0 litres of blood. The reason for the kidneys, liver, heart and brain receiving more than half the total cardiac output can be that :-  
(A) they are big organs  
(B) they are located in the centre of the body  
(C) they are compact organs  
(D) they are most active organs and majority of the cells work almost 24 hours
- 98.** The blood proteins involved in blood clotting are :-  
(A) gamma globulin and haemoglobin (B) prothombin and fibrinogen  
(C) albumin and prothrombin (D) collagen and fibrinogen
- 99.** A blood vessel which has thick strong muscular wall is :-  
(A) artery (B) vein (C) capillary (D) lacteal
- 100.** The backward flow of blood in the veins is prevented by the presence of :-  
(A) thin walls (B) thick walls (C) heart beat (D) valves

\*\*\*\*



# Answers

## Exercise-I

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (B)  | 2. (A)  | 3. (A)  | 4. (B)  | 5. (D)  |
| 6. (B)  | 7. (D)  | 8. (B)  | 9. (C)  | 10. (D) |
| 11. (D) | 12. (A) | 13. (C) | 14. (D) | 15. (A) |
| 16. (B) | 17. (B) |         |         |         |

## Exercise-II

### Section-A

- |                  |                                |
|------------------|--------------------------------|
| 1. ATP           | 2. Heart, blood & blood vessel |
| 3. gum and resin | 4. Bowman capsule              |
| 5. A             |                                |

### Section-B

- |         |         |         |         |         |
|---------|---------|---------|---------|---------|
| 1. (A)  | 2. (D)  | 3. (D)  | 4. (B)  | 5. (A)  |
| 6. (A)  | 7. (C)  | 8. (D)  | 9. (D)  | 10. (B) |
| 11. (D) | 12. (A) | 13. (C) | 14. (B) | 15. (A) |
| 16. (D) | 17. (B) | 18. (A) | 19. (A) | 20. (A) |
| 21. (C) |         |         |         |         |

### Section-C

- |            |              |          |          |          |
|------------|--------------|----------|----------|----------|
| 1. (A,B,C) | 2. (A,B,C,D) | 3. (C,D) | 4. (B,C) | 5. (A,B) |
|------------|--------------|----------|----------|----------|

### Section-D

- |        |        |
|--------|--------|
| 1. (B) | 2. (B) |
|--------|--------|

### Section-E

- |                                       |
|---------------------------------------|
| 1. (A)-(R), (B)-(P), (C)-(S), (D)-(Q) |
|---------------------------------------|

### Section-F

- |        |        |        |
|--------|--------|--------|
| 1. (C) | 2. (B) | 3. (B) |
|--------|--------|--------|

### Section-G

- |   |
|---|
| 1. (A)-(Q), (B)-(Q), (C)-(P,Q,R), (D)-(P,R) |
|---|

## EXERCISE-III

Q.No	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Ans.	B	D	D	C	A	B	B	D	B	D	C	D	B	A	B	C	B	B	D	B
Q.No	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Ans.	D	B	A	C	A	B	B	D	C	D	B	D	A	B	D	D	D	A	A	B
Q.No	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	A	C	B	C	D	B	D	A	D	A	D	D	B	C	B	A	D	C	A	C
Q.No	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
Ans.	D	B	A	B	D	D	C	B	D	D	C	A	D	D	C	B	D	D	A	A
Q.No	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
Ans.	A	C	B	B	B	B	B	A	D	D	C	A	C	A	D	C	D	B	A	D

